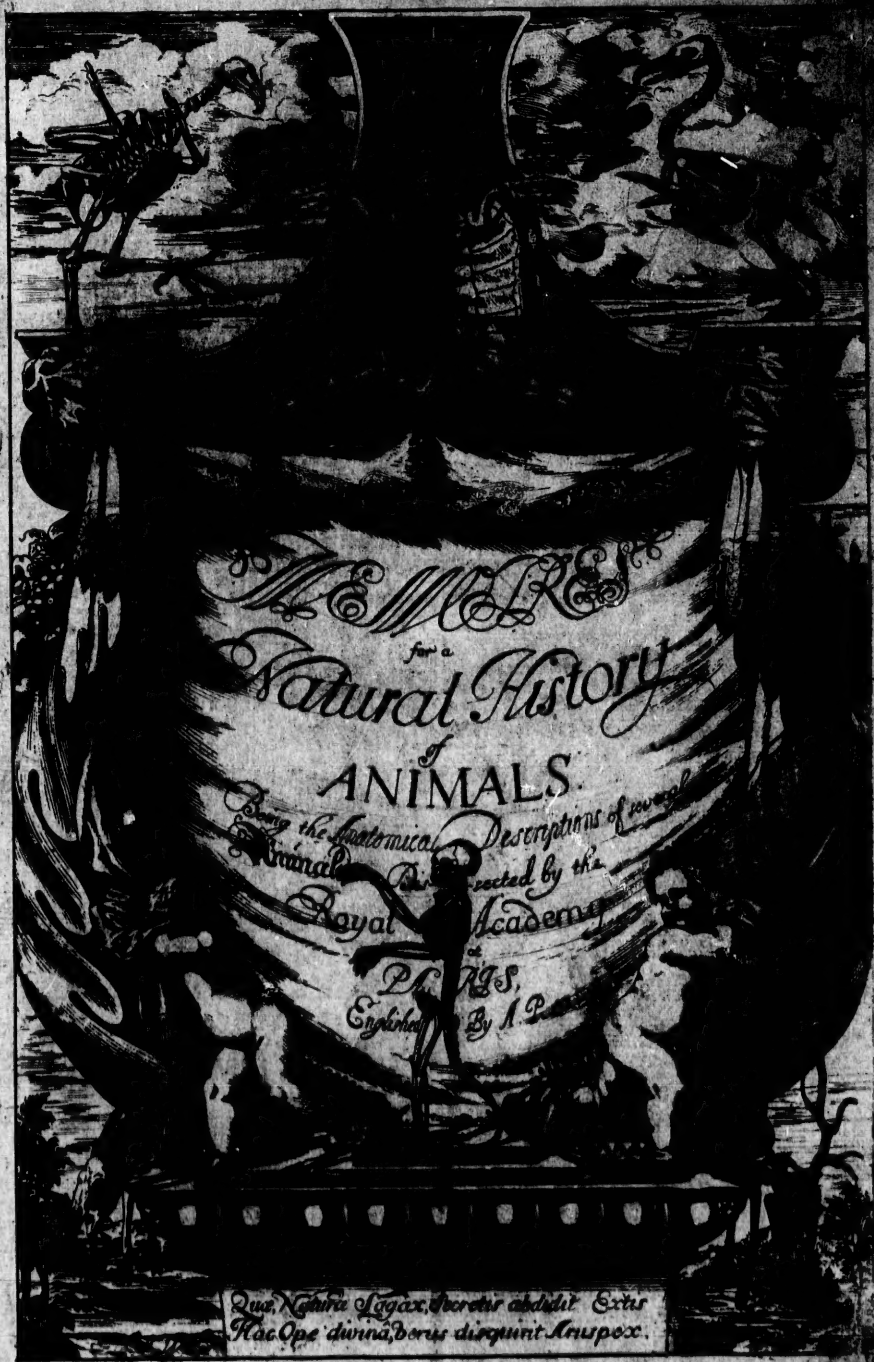
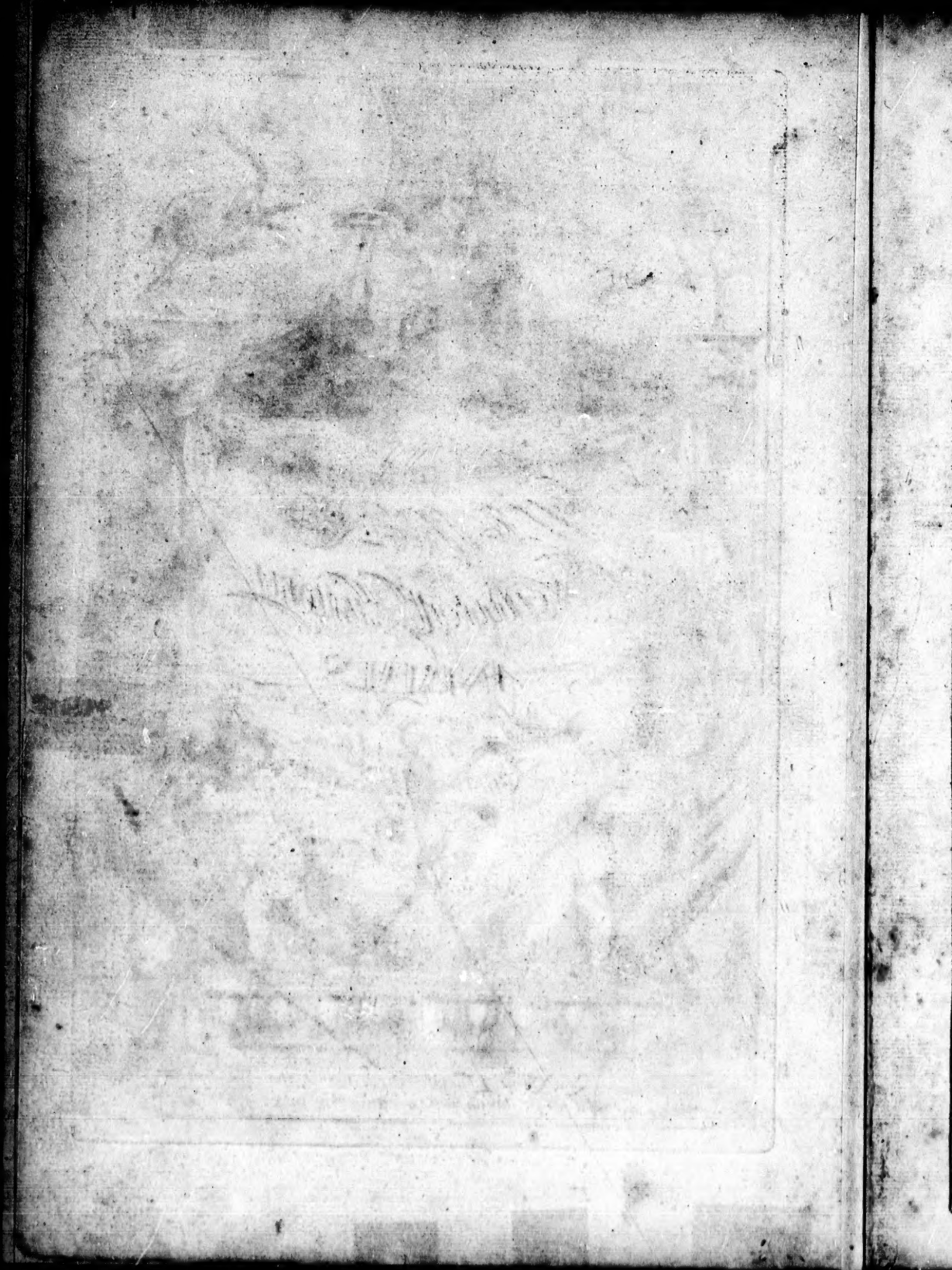






THE
NATURAL HISTORY
OF
ANIMALS
CONTAINING THE
Anatomical Description
OF SEVERAL
CREATURES
DISSECTED BY
The Royal Academy
OF
SCIENCES at PARIS.
WHEREIN

The Construction, Fabrick and genuine Use of the Parts, are exactly and finely delineated in Copper Plates, and the whole Enriched with many Curious Physical and no less useful Anatomical Remarks, being one of the most Considerable Productions of that Academy.

Done into English by a Fellow of the Royal Society.

To which is added

An Account of the Measure of a Degree of a great Circle of the Earth, Published by the Members of the same Academy : English'd by R. W. SRS.

With an *Alphabetical Table* of the Names of the several Animals mention'd in this Volume. And likewise an *Alphabetical Index* to make the Work Compleat.

Publish'd by an Order of Council of the Royal Society

L O N D O N,

Printed for R. Smith, at the Angel and Bible without Temple Barr, 1702.

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DESCRIPTION

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Done into English by a Society of the Learned Society.

An Account of the History of a Society of Learned
Gentlemen of the University of Paris, the Members
of the Academy of Sciences, &c.

RARE

41

2A

With a Description of the State of the Academy, and the
History of the Academy, and the History of the Academy.

Printed by the Order of Council of the Academy.

ADAM

Printed for E. Smith, at the ... and ...

THE
PUBLISHER
To The
READER.

THese Famous Memoir's containing the Anatomical Descriptions of several Animals (and those all Exotic and scarce to be procured) together with very excellent Observations thereon, are some of the first-fruits and accurate performances of the Royal Academy of Sciences at Paris. They were by them some time since so Magnificently, as well as Curiously set forth in two Volumes, that (as they seemed not to be designed for common Sale, so) they became Presents only from the King, or Academy, to Persons of the greatest Quality, and were hereby rendered unattainable by the ordinary Methods for other Books. And altho' by some few, who (through this means) had the opportunity of perusing them, they were found full fraught with very Pertinent, as well as Curious Observations; yet so great was the difficulty in procuring the favour of such a perusal (not only here in England, but even at Paris it self) that the Ingenious Labours of that Illustrious Society were hereby made less Useful and Ineffectual to their great Design; most of the Learned being totally deprived of the singular Advantages that might be obtained therefrom.

For these Reasons it was judged that the exhibiting of this admirable Treatise in an English dress, might prove no unacceptable Present, it being a Work enriched with many Curious Physical, and no less Useful Anatomical Remarks, of great Importance to the Promotion and Improvement of Natural Knowledg; especially that part which respects the Construction, Fabrick, and Genuine Use of the Parts of Animals, and even of Man: A Knowledge no way better to be obtained than from the Comparative Anatomy of divers Animals; that Texture of Parts being discoverable in one Animal, which Nature has conceal'd and made more obscure in another.

These Considerations, backt with the earnest Importunities of several Friends, and the hopes of being serviceable to the Ingenious Inquirers into Nature, so far prevailed upon me, that (in compliance to their desires, and
for

TO THE READER.

for the publick Benefit) I undertook this Edition, wherein I have used my utmost endeavours for the rendering a faithful Translation thereof; still keeping as near as I could to the true sense of the French Copy, and varying as little therefrom as the Nature of the English Language would permit. How far they have herein succeeded, is wholly submitted to the Censure of the Learned, whose kind acceptance of these performances may prove a farther Motive to present them with some other things of this kind, whereby the useful Application of these, and divers others of the like Nature will more evidently appear.

But there was one thing more difficult to be overcome (at least by me) than what I have hitherto mentioned, and that was the presenting you with the Figures and Delineations, which in the French Edition are exceedingly accurate, as well as skillfully Engraven in Copper. And herein Gratitude obliges me to acknowledg the great kindness of Mr. Richard Waller, without whose Assistance I should have been at a loss, and this Design would have fall'n to the Ground: But his Zealous endeavours to promote Natural Discoveries soon prevail'd with him to ingage himself in this more difficult Task: And accordingly he proportioned and wrought them after the French Originals, with as much exactness as was possible; and altho' to accommodate them to this Volume, he was necessitated to contract and lessen the size, yet has he so well disposed of the Parts of each Plate, that what is most material is very plain and clearly Intelligible. Most of the Animals are represented three quarters as bigg as in the Originals, and all the Dissected Parts half as bigg; excepting some few as bigg as the Life, which is expressed in their particular Explanations. His great Care in thus nicely contracting the Plates, and allowing to each part its due Symmetry and Proportion are sufficient Testimonies of his Skill in Designing, which with his other Abilities being already well known to the Royal Society, I must (by reason of his Modesty and my near Relation) forbear giving him those Praises which in Justice belong unto him.

To him also I am oblig'd for furnishing me with the Translation of the Observations made for Measuring a Degree upon the Earth, which tho' it be a Subject of a differing Nature, yet being one of the most considerable Productions of the same Illustrious Academy, and being joyned to one of the Volumes in the French Edition, I conceived it would be as pertinent and proper to accompany them in English.

Thus have I given you a short account of this following undertaking, hoping you may hereby receive as great Satisfaction in perusing, as I have done in translating these Memoir's.

ME-

For besides the great and Magnificent Works which Nature has
 given, and which have composed of what they found in other An-
 imals, which they learn from those who find them in other An-
 imals, they have likewise some particular Observations which
 Travellers have written of Abundance of Animals which are found
 only in the Countries where they have been: And those who
 have made the History of the Animals of the World, have
 not forgotten that of the Animals which are to be found. But

MEMOIRES FOR THE NATURAL HISTORY OF ANIMALS

HISTORY, of what Nature soever it be, is written after two
 Ways: In the one are related all the things which have been
 at several times collected, and which do belong to the Subject
 it Treats of. In the other we are confined to the Narrative of some
 particular Acts, of which the Writer has a certain Knowledge. This
 last way, which the Romans did call *Commentaries*, and the French,
Memoires, although it contains only the Parts, and as it were the
 Elements which do compose the Body of History, and has not the
 Majesty found in that which is general, yet claims this Advantage;
 that Certainty and Truth, which are the most recommendable Quali-
 ties of History, cannot be wanting in it, provided the Writer be
 exact and sincere; which is not sufficient for the general Historian,
 who oftentimes cannot be true, how desirous soever he be after the
 Truth, and what care soever he impley's to discover it; because
 he is allways in danger of being deceived by the *Memoires* on
 which he builds.

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We have store of Histories of Animals of both these ways; For besides the great and Magnificent Works which *Aristotle*, *Pliny*, *Solinus*, and *Ælian* have composed of what they found in other Authors, or which they learnt from those who had made some Observations themselves; We have likewise some perticular Relations which Travellers have written, of Abundance of Animals which are found onely in the Countries where they have been: And those who have made the Description of the several Parts of the World, have not forgotten that of the Animals which are there to be found. But it may be said that there is not found any certainty in these Histories, nor in these Relations. Those who have writt the General History of Animals, have thought to render it sufficiently acceptable by the great number of things which they do relate, and by the distribution which they do make of the Animals into their different Species; with their resemblances and differences which are found in their parts of which the various conformation, and all their Natural properties are ranged in some common *Classes*. For it is in this that they have chiefly employed their dilligence and industry, the rest not belonging to them, but to those who had made the Description of the Animals on the places, and whose exactness, and fidelitie could not be sufficiently known to them, to answer for them. So that the Materials, of which these Authors have composed their Works, being for the most part defective and layd on sandy Foundations, it may be truly said that the great Structure which they have afterwards built thereon, with so curious a Symmetry, has no real Solidity.

Therefore the Curious and Learned, who had formerly but little valued the worke of *Petrus Gillius*, when he undertook to methodize what *Ælian*, had confusedly related of Animals, have been much concerned at the loss of the excellent Remarks which he afterwards made, in the Travels which *Francis. I.* Caused him to take into Forreign Countries. For he was a very Judicious and perspicacious Man; who was instructed by reading of all Authors that writt on this Subject, and was purposely sent by the King to make this search, and who applied himselfe thereunto with a particular care; which made him capable of observing whatever was remarkable in Animals.

The want of these Qualifications, in the generality of those which have made particular Relations and *Memoires*, renders their Labour inconsiderable, and their Testimony very suspicious: It being

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being scarcely probable, that Merchants and Souldiers are indowed with the Spirit of Philosophy and Patience, which are necessary for the observing all the nice Particularities of so many different Animals, whose extraordinary Shape did at first satisfy all their Curoisity, as being capable of sufficiently enriching their Relations; without judging it necessary to proceed to an exacter Scrutiny. But that which yet more lessens the Esteem for these sorts of *Memoires*, is the unfaithfulness which Travellers do generally use in their Relations; who almost always add to the things they have seen, those which they might have seen; And least the Narrative of their Travels should seem imperfect, do recite what they have read in Authors, by whom they are first deceived, just as they do afterwards deceive their Readers. This is the Reason why the Protestations which several of these Observers, as *Belonius*, *Piso*, *Margravius*, and some others do make, to say nothing but what they have seen, and the Assurances which they do give of having discovered a great many of the fallacies which have been writt before them, have scarce any other effect, than to render the sinceritie of all Travellers very suspect, because that these Censurers of the good Credit and exactness of others, do not give sufficient Cautions of their own.

That which is most considerable in our *Memoires*, is, that unblemishable evidence of a certain and acknowledged Verity. For they are not the Work of one private Person, who may suffer himself to be prevail'd upon by his own Opinion; who can hardly perceive what contradicts his first Conceptions, for which he has all the blindness and fondness, which every one has for his own Children; who is not contradicted in the freedom that he allows himselfe, of uttering what ever he thinks capable of adding luster to his Work; and indeed who less considers the Truth of the Facts, which are not his own Production than that order he gives it, and which he frames to himselfe, of some particularities which he supposes, or disguises, to indeavour to suite them to his own Design: So that he would be in some Measure concerned at the finding out of Truths, and making Experiments which would destroy his fine Speculations. But these Inconveniencies are not to be found in our *Memoires*, which do contain only Matters of Fact, that have been verified by a whole Society; composed of Men which have Eyes to see these sorts of things, otherwise than the greatest part of the World, even as they have Hands to seek them with more dexterity and success;

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who themselves what is, and who are not easily to be made to see what is not; who study not so much to find out Novelties, as carefully to examine those pretended to be found; and to whom even the Assurance of being deceived in any Observation, brings no less satisfaction than a curious and important discovery: So much the Love of Certainty prevails in their spirit above all other things.

Now this Affection is so much the stronger, as it is not opposed by any other interest, seeing that the Vain-glory, which the success of an ingenious delusion might have gained by surprise, would signify very little being divided amongst so many persons, who do all contribute to this work: Either by the Propositions which every one makes of the Novelty which he discovers; or by the Light and Illustration which his censure gives to the discovery's of others; by examining them, as his are done, with a care which a small Principle of Emulation, never fails to excite amongst Philosophers. So that it is very probable, that what ever has undergone so severe a Tryal is exempt from all mixture of Falshy and Imposture.

This Exactness to advance nothing but what has been verified, is that which has made *Demonstrations* so greatly extol'd amongst the Ancients; when having collected a great abundance of strange Curiosities, it is reported that in his Collections he marked with his own Seal, those of which he Experimentally knew the Truth, to compose a Volume of them, which he intitled the *Book of Choice*. Thus after his Example it is that we design that this Collection, be a choice of all that ever has been found and carefully remarked in the Animals which could be examined.

In this Collection we have particularly insisted on that which belongs to the structure of the Parts of Animals, rather than that which concerns their Natures, Nourishment, the way of taking them; their Qualities in Physick, and the other uses which are attributed to them; of which all Natural Historians have composed their Volumes; and of which we have spoken only Transiently, and according to the Occasion which what we observed in our Subjects, afforded us; But this design of Describing only the Parts, has been restrained to those within; and it is for that Reason, that we do call the *Descriptions* which we make, *Anatomical*, altho' they do contain a great many things which may be seen without Dissection.

Indeed,

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Indeed, our chief Aim being to report, and collect all the Remarks, which we have made on the different particularities of the inside of Animals; we could not omit the other Observations which belong to the exterior Form, by reason of the Relation that all the parts have each to other. But we stay not long on things which do not directly appertain to this *Anatomical Knowledge*, because that there is little less, but this exact Description of the internal Parts, wanting to *Natural History*. We could not (likewise) sometimes avoid digressing out of that strait and narrow Road, which we proposed to follow; and we have thought our selves obliged to enter into the Controversies which are amongst Naturalists, touching the difficulty that there is of knowing, whither some of the Animals which we have, are precisely those which the Antients have spoken of; because that the Descriptions of these Authors are generally very Ambiguous; and agree not sufficiently amongst themselves, to take away the doubts which may arise, that the Animals to which they do give the same Name, are not sometimes different; and that those also which the Vulgar call otherwise than they have, are not the same which they have spoken of. The particular and new Remarks which we have made, have engaged us to this Examination: But we pretend not to put a value on our Conjectures, farther than particular Facts can prove them; being ready to retract, when it shall happen, that a great number of contrary Observations shall demonstrate to us, that these first were made upon Subjects, the formation of which, was extraordinary; and consequently insufficient and incapable, of establishing a general Conclusion: But we have thought, that things of this Nature might be put into *Memoires*, which are as it were *Magazines*, wherein are lockt up all sorts of things, to be made use of in time of need.

Now altho' we stick only to this Description, and this lively Painting, which we have endeavoured to perform simply, and without any Ornament, and have no other intention, than to discover things such as we have found them, and even as in a Glass, which adds nothing of its own, and which represents onely what has been presented to it: Yet we have not forbore sometimes to add Reflexions, when we have thought it necessary, upon particularities that deserved it; and that onely as a Sample, and first Fruits which might be gathered, when by the collecting of all the

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Observations which may be made, this Work will be sufficient to afford Matter enough, for the composing an intire and compleat Body thereof. So that it is to be understood, that we design not that the Reflexions which are here preparatorily made, do pass for decisions, but only for Essays of what may be expected from this sort of Work.

There are some who have found fault with that great Work of *Aristotle's History of Animals*, because they fancy that this Author discourses therein, more like a Philosopher than an Historian; but this is not the Opinion of the most part of the Curious, who think that he has too much confined himself to the Character of a bare Relation; and that it is a great damage that he has not more explain'd himself on all the things which he could discover, by the assistance of the admirable Light which he had in all sorts of Sciences: And the Opinion of *Hierocles* is very probable, who says that the ten Books which we have of *Aristotle's History*, are only an Abridgment which *Aristophanes Bizantinus* made of the Fifty Volumes that *Pliny* has spoken of, in which was contain'd all that which may belong to the intire and perfect knowledge of Animals.

But as it is impossible to Philosophize without making some general Propositions, which ought to be grounded on the knowledge of all particular things, whereof Universal Notions are composed; and that we still have a long time to work, before we can be instructed in all the particulars necessary for this End: We believe that there will not be overmuch reliance on the Reasons, which we have intermixt amongst our Experiments, and that it will easily be judged, that we pretend only to answer some Matters of Fact which we advance, and that these Facts are the sole Powers whereby we would prevail against the Authority of the great Persons which have writ before us; seeing that speaking of them with all the Respect which they deserve, we do own that the defects which are seen in their Works, are there only, because it is impossible to find any thing which has acquired the utmost perfection: Altho' these Works do nearly enough approach it to be inimitable, and to make all those who are rational and intelligent, to have a singular Veneration for the Excellent *Genius's* which have produced them: For we do think we render a greater Honour to the Merit of the Antients, by Demonstrating that we have discovered some small slight Errors in their Works, than if after the manner of those who di-

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distrust their own understanding, and never ground the Judgment which they do make of the value of any thing but on Prejudices ; we should esteem them only, because we thought they were done by great Personages, and not by reason of the Knowledge which we have of what they have done well or ill : Because, that as the greatest *Encomium*, which a hundred blind Persons might give to a Beauty, would not be so advantageous, as the meanest of a single Person who had good Eyes : The approbation likewise, which a general consent of all ages has given to the Works of great Personages, could not be well grounded, if it did not appear that it had been done with Discretion, and consequently with Examination, by which it has been verified, that whatever it may have defective is nothing, in comparison of the vast Number of curious and excellent things which are there found.

We suppose, that such as are capable of these Reflections, will not have the Malignity to make use of the Authority given to a great number of those, who being incapable thereof, would have us like themselves, retain a blind Veneration for the Works and Sentiments of the Antients ; and we do hope, that rational Men will not be so injurious, as to render odious the Liberty which we have assumed, of saying that our Descriptions are exact, because that we propose nothing but what we have seen ; and that we do pretend, that they are exacter than those of the Ancients ; which are made for the most part on the Reports of others : Seeing that we do not impertinently affect to mark the Errors of these great Men, and that we do only advertise the Reader, that our Observations agree not with theirs. For we think not that this comparison of our Diligence with their Remissness, a vain Ostentation and utterly unprofitable ; seeing that it may contribute to an instruction more precise, and which better imprints the Idea's of things, when their true Description is distinguished, and marked by the opposition of that which is false : Or however this demonstrates, supposing both the contrary Observations to be true, that one may conclude, that in consideration of the Particularities wherein we differ, Nature is variable and inconstant.

For which Reason, we have chosen a particular way of making our Descriptions. For whereas the Ancients and generality of the Moderns, do handle the Doctrine of Animals, like that of the Sciences, always speaking in general, we only expose things as singular ;

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lar; and instead of affirming, for instance, that the *Bear* has Fifty-two *Kidneys* on each side, we say only that a *Bear* which we dissected had the *Conformation* thereof very particular; and in describing it, if we testify our Admiration that no one has made this remark, and that even those who have made the Anatomy of these Animals are silent therein; it is because that we suppose that Nature, who rarely sports her self in the conformation of the Principal Parts, has formed the *Kidneys* of other *Bears* after the same Fashion, as we have found them in our *Subject*.

In the Description of rare Animals, which do come from Foreign Countries, we have been particularly careful to represent their external Form exactly, and to denote the size and proportion of all the Parts seen without the Dissection: Because these are things almost as little known, as what is within the Body. The familiar Animals are otherwise described: For the bigness, form, and situation of their parts, as well exterior as interior are compared to those of Man, whom we do establish as the Rule of the Proportion of all the Animals: Not that we do think that he is absolutely better proportioned than the most deformed Beast: Because that the Perfection of every thing depends upon the Relation it has to the End for which it is made: And it is true, that the Ears of an *Ass*, and the Snout of a *Hog*, are parts as admirably well proportioned, for the uses to which Nature has designed them, as all those of Man's Visage are, to give him the Majesty and Dignity of the Lord of all the Creatures: But it is necessary to agree of some one Measure and *Module*, as is observed in *Architecture*: And considering the whole Universe as a great and statley Edifice, which has several Apartments of a different structure, the proportions of the most Noble are pitcht upon for the Regulating all the rest. So that when it is said, for Example that a *Dog* has a long head, little stomach, and the legg all of one thicknes, it is onely in comparing these parts with those which are found of the same kind in Man. We do likewise describe all the parts of Man's Body, altho' there are not so many new things to speak of, as those of other Animals; it being very difficult to add any thing to the Ancients and Moderns, who have handled this Matter with all the exactness imaginable, and with a success comparable to the Grandure and Dignity of the Subject. To a great number of particular Observations which we have made, we added all the other Remarks which are common to

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us with other Authors, and which we do not give for new; but only as being in some sort considerable, by reason of the certainty and credit, which the Testimonies of so many Persons who have contributed to these Descriptions, may add to the Facts which we declare.

This so precise exactness in relating all the particulars which we observe, is qualified with a like care to draw well the Figures, as well of the intire Animals, as of their external Parts, and of all those which are inwardly concealed. These Parts having been considered, and examined with Eyes assisted with *Microscopes*, when need required, were instantly designed by one of those upon whom the Company had imposed the charge of making the Descriptions; and they were not graven, till all those which were present at the Dissections found that they were wholly conformable to what they had seen. It was thought that it was a thing very advantageous for the perfection of these Figures to be done by a Hand which was guided by other sciences than those of Painting, which are not alone sufficient, because that in this the Importance is not so much to represent well what is seen, as to see well what should be represented.

Our *Memoires* being thus composed it is to be hoped that they will afford Matter for a *Natural History*, which will not be unworthy of the Greatest King that ever has been; and that if in this to equal *Alexander*, as he equals and surpasses him in all other things, he wants so great a Person as *Aristotle*, the care which His Majesty has taken to supply this Defect, by the Number of Persons which he has chosen for this Employ, and by the Order observed to perform the things with an absolute exactness, will make this Work, which was undertaken by his Command, not inferior perhaps, to that which has been done for *Alexander*.

The Explication of the Figure of the L Y O N.

IN the lower Figure he is represented alive, his Head turned on one side, as he sometimes carries it; notwithstanding the stiffness of his Neck. The Claws tho' very great are indiscernable, being covered with hair, which is very long at the extremity of the Paws. The Form which the Tail has under the Hair is not seen, by reason of the different length of the Hair, which makes it to appear of equal thickness from the beginning to the end.

In the Parts which the Dissection discovers.

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| <p>A. The Crest of the Cranium.
 B B. The Zygoma.
 C c. The great and little Canini.
 d. The Incisores.
 E. The Apophysis Coronoides of the lower Jaw.
 F F F. The Molares.
 G. The extremity of the Radius.
 H. The extremity of the Cubitus.
 I I. The Bones of the Carpus.
 1 1 1 1. The four Bones of the Metacarpus.
 2 2 2 2. The four Bones of the first Phalanx of the Toes.
 3 3 3 3. The four Bones of the second Phalanx.
 O O. The last Bones of the Toes. We have represented one a part, and one of its articulation, which with the two others marked 2, 3, which are likewise separated from the rest of the Paw, makes one of the Toes. You may observe the bending which the Bone marked 3, has at its extremity, which makes a Condylus or Protuberance, to make room for the last Bone, which is articulated to it, to bend upwards.
 K. A part of the Skin of the Tongue, seen with a Microscope.
 L L. Little Eminencies, which are near the root of every one of the Points which are upon the Tongue.
 M M M. The Points which make the Tongue rough.
 N. One of the Points Separated from the Skin, to shew its cavity.</p> | <p>O. The Gall-Bladder.
 P. The Ductus Cholidochus.
 Q. The Bladder.
 R R. The Prostatæ.
 S S. The Ligaments, which joyned with the Urethra do compose the Body of the Penis.
 T. The beginning of the Urethra.
 V. The Balanus.
 X. The Humor CrySTALLINUS, which was spoils.
 Y. The other CrySTALLINUS which was found.
 T. The Tongue.
 Δ. The Cartilago Thyroides of the Larynx.
 Θ. The Cartilago Cricoides.
 Λ. The Cartilago Arythenoides.
 E. The Glottis.
 Σ. The Epiglottis.
 Φ. The lowest part of the Stomach.
 T. The Pylorus.
 α. The Oesophagus.
 β β. The Arteria.
 ζ. The left Auricle of the Heart.
 δ. The Heart.
 ζ. The right subclavian Artery.
 η. The right Carotides.
 Θ. The left Carotides.
 x. The left subclavian Artery.
 λ λ. Part of the Diaphragme.
 μ. The superiour Orifice of the Stomach.
 ν ζ. two protuberancies which were at the fore-part of the Stomach.
 1, 2, 3, 4, 5, 6, 7, 8, The Lobes of the Lungs.</p> |
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to observe in all the Descriptions of the other Animals. We found that the greatness of the Head, which is remarkable in this Animal, consisted chiefly in the extraordinary abundance of the Flesh which covered it, and in the greatness of the Bones which compose the Jaws. That the *Breast* likewise, which appeared large, was only by reason of the long and thick Hair which encompassed it, the *Sternum* being compressed, and much more pointed, than it is in most *Horses* and *Dogs*: And that by the same reason, the *Tail* seemed not to be of equal thickness from one end to the other; but by reason of the inequality of the Hair wherewith it was invironed, which was shorter towards the beginning, where the Flesh and Bones are thicker, and which grew longer as these parts grow lesser and lesser, towards the end. And that this long Hair which is about the Neck and Breast, did differ from that of the rest of the Body only in its length, having nothing resembling Man's Hair.

THE ANATOMICAL DESCRIPTION OF A L Y O N.

BEfore the opening of our Lion, we carefully examined all its external Parts, according to the Method which we proposed to our selves, to observe in all the Descriptions of the other Animals. We found that the greatness of the Head, which is remarkable in this Animal, consisted chiefly in the extraordinary abundance of the Flesh which covered it, and in the greatness of the Bones which compose the Jaws. That the *Breast* likewise, which appeared large, was only by reason of the long and thick Hair which encompassed it, the *Sternum* being compressed, and much more pointed, than it is in most *Horses* and *Dogs*: And that by the same reason, the *Tail* seemed not to be of equal thickness from one end to the other; but by reason of the inequality of the Hair wherewith it was invironed, which was shorter towards the beginning, where the Flesh and Bones are thicker, and which grew longer as these parts grow lesser and lesser, towards the end. And that this long Hair which is about the Neck and Breast, did differ from that of the rest of the Body only in its length, having nothing resembling Man's Hair.

The *Claws* had no cases, as *Pliny* reports they have, to keep them from being dulled by their walking; but it appears rather, that these Animals, as *Plutarch* and *Solinus* observe, do provide for that by retracting them between their Toes, by the means of the particular Articulation of the last Joynt, which was such, that the last Bone gave one, by bending it self outwards, gives place to the last which is articulated to it, and to which the Claw is fastened to bend it self upwards and side-ways, more easily than downwards; being drawn upwards by the means of a tendinous Ligament, which fastens together the two last Bones in their superiour, and external part only; and which suffering a violent distention when the Toe is bent inwards, extends this last Articulation, as soon as the *Musculi flexores* come to slacken, and strengthens the Action of the *Musculi extensores*: So that the Bone which is at the end of every Toe, being almost continually bent upward, it is not the end of the Toes which rests upon the ground, but the Node of the Articulation of the two last Bones; and thus in walking, the Claws remain elevated, and retracted between the Toes, to witt, all those of the right Paws, towards the right side of every Toe, and all those of the left Paws, towards the left

side; The *bending* of the *Toes* to walk being caused only by the *Tendons* of the sublimer Muscles and those of the lower Muscle never moving but when it is necessary to extend the *Claws*, which do proceed out of the *Toes*, when the last Joynt is bent downwards. This admirable Structure is not found in the great Toe, whose last joynt bends only downwards, because that this Toe rests not on the ground being shorter than the rest, and having but two Bones as is usual.

It had fourteen *Teeth* in each Jaw, viz. four *Incisores*, four *Canini*, and six *Molares*. The *Incisores* were little, and the *Canini* very uneven, having two great and two small ones. The great ones which were an inch and half long, like the Tusks of a Boar, are those alone which *Aristotle* takes for *Canini*: But each of these great *Canini* was accompanied with another little one, which was at the side of the *Incisores*, and which left in the upper Jaw, between it and the great one, as much void space on each side, as was necessary to lodge and insert the *hook* of the great *Caninus* of the inferior Jaw, in which there was likewise a space between the great *Caninus* and the first of the *Molares* designed to lodge the great *Caninus* of the upper Jaw, but which was much larger, to the end that the lower Jaw might be advanced forward upon occasion. The *Molares* were likewise very uneven, especially in the upper Jaw, where that which stood next the *Caninus* was as small as the *Incisores*. The other *Molares* were very large, having three unequal points, which represented as it were the flower de Lys.

The Neck was very stiffe, as Authors have remark'd. But the Dissection has demonstrated to us in our *Lyon*, that this proceeded not, as *Aristotle* and *Ellian* have reported, from its having only one Bone, but rather for that the spinous processes of the *Vertebrae* of the Neck were very long, and bound with Ligaments so strong and hard, that it seem'd composed of one single Bone. *Sealiger* says that he had observed the same thing in the Dissection of two *Lions*: And it is probable that *Aristotle* has so understood it, when in his *Physiognomy* he say's, that the Body of the *Lyon* is remarkable for the greatness and firmness of its Joynts.

The Tongue was rough and covered with a great many sharp points, of a Substance hard, and like to that of the Nails of *Cats*, whose bigness they also had: These points being hollow at their Basis, and crooked towards the throat. They were almost two lines in length, and towards their Basis had little round Eminencies, made of the fleshy skin of the Tongue.

The Eyes were clear and brisk after death, and through the Foramen of the *Nuca* was seen the bottom of the *Choroides*, which was as it were gilt. The *Tunica Conjunctiva* was black. It is probable that the reason of saying, that *Lions do Sleep with their Eyes open* is that without shutting the Eye-lids, they can cover them with a thick and black Membrane lay'd towards the great *Canini* which raising and stretching out it self towards the lesser, can extend it self over all the *Cornea*, as is observed in *Birds*, and especially in *Cats*, which have so great a conformity with the *Lion*, that we have found that there was some ground for the fable of the *Alcoran*, which says that the *Cat* was first born in the Ark by the sneezing of the *Lion*. For the particular structure of the Paws, Teeth, Eyes and Tongue, which we have observed in the *Lion*, is found to be common with the *Cat*; And the internal parts of these two Animals have the same conformity, altho' *Allertus* affirms the contrary.

At the first opening, the Skin seemed not to us extraordinary hard, nor impenetrable, as Cardan reports; but it was found strongly connected by a number of hard and nervous Fibres which proceeded from the *Muscles* and penetrated the *Panniculus carnosus*.

The *Oesophagus* was not so large that the *Lion* could swallow, as some Authors tell us, the members of Animals all intire; for it exceeded not an inch and half in breadth, and was drawn together by the *Foramen* of the *Diaphragm* after the usual manner, being not open and dilated, as it is in most *Fishes* and *Serpents*, which do easily swallow whatever enters into their Mouth.

The *Stomach* was eighteen inches long, and six broad, situated from the top to the bottom, inclining a little to the right side, and rising towards the *Pylorus*. At the Superiour and Anterior part there were two unequal *Protruberancies*.

The *Intestines* were not very long, comprehending all together but twenty five foot, the *Colon* eighteen inches, and the *Appendix* of the *Cacum* three.

The *Pancreas* was like to that of *Cats* and *Dogs*, and the great *Glandules* of the *Mesentery*, which are by *Acellius* called *Pancreas*, were also like to those of these Animals.

The *Liver* in which we found seven lobes as in *Cats*, was of so dark a red, that it inclined to a black: It was also very soft. Its hollow part under the *Gall-bladder* was filled with choller diffused into it's Substance, and into that of all the Circumjacent parts; which was the sole Circumstance that gave us some suspicion of the cause of this Animals death, which we judge to be the Disease, to which *Pliny* alone say's *Lions* are subject, and which he calls *Agritudine fastidii*: For whether this be understood of the mortal trouble which it conceives of its captivitic, as that Author expresses it, or that this signifies the disgust which kills him for want of eating, it is well known that the retention of the choller may cause either.

The *Gall-bladder* was seven inches long and one and a half broad. Its Structure was very particular, being anfractuous towards the *Meatus Cholidochus*, and as it were seperated into several cells: *Cats* have exactly the like.

The *Spleen* was a foot long, two inches broad, and half an inch thick. It was not so black as the *Liver*, notwithstanding that general rule which *Galen* gives of the colour of the *Spleen*, which he says is always blacker than the *Liver*, especially in Animals which are of a Temperament hot and dry, and which have sharp Teeth. So that there is great probability that this blackness of the *Liver* was extraordinary in this Subject, and not natural. The *Kidney* was almost round, being three inches and a half in length to two and a half in breadth and thickness: It weighed seven ounces and two drachmes.

The *Parts of Generation* had this particular, that the *Urethra* was not crooked, but quite strait from the *Bladder* to the extremite of the *Penis*; and that the beginning of the *Ligaments*, which with the *Urethra* do compose the body of the *Penis*, was very remote from the *Prostata*, which are at the beginning of the neck of the *Bladder*: So that the *Urethra*, which in all contained eleven inches, extended not, being joyned to these *Ligaments*, the length of three inches and a half: Which made us to doubt of the truth

of what *Aristotle* says concerning the *Physiognomie* of the *Lion*, to witt, that he has eminently, and above all other Animals, visible and apparent signes of the strength and perfection of his Sex.

The reason of this Structure appears to us to be founded on the extraordinary breadth of the *Os pubis*, along which the *Creshra* must descend from the *Bladder*, the bottom of which must pass over the *Bones*, to their inferior part, from whence ariseth these Ligaments which do compose the *Penis*. This Conformation makes the the *Lion* to piss backwards, and not by lifting up the *Legg*, like *Doggs*, as *Pliny* say's, and that he couples with the *Lionness* after the same manner as *Camells*, *Hares*, &c.

In opening the *Thorax* it was observed, that from all the *Cartilages* of the *Sternum* which had been cut, there came out two or three drops of Blood, which demonstrated that these parts are not so solid, as that their cavities should be imperceptible, as some Authors do think, seeing that they are penetrated by some Sanguinary Vessels, as is seen in all Animalis when young.

The *Mediastinum* was furnished with abundance of great vessels. The Membranes which composed it, and which were perforated like a net, were joyned, and left no space but towards the *Diaphragme*, on the right side of the *Heart*, where there was a very large and ample cavity. The same thing is observed in *Catts*.

The *Lungs* were found to have six Lobes on the right side, and three on the left. All the *Annular cartilages* of the *Aspera Arteria* made an entire circle, excepting two or three under the *Larynx*, in which besides their greatness, which was four inches in compass, there was not more than two lines which were not entire. The breadth of this Organ of the voice seem'd to us very capable of making the dreadful noise of its Roaring.

The *Ductus lacteus Thoracicus* was very small, and joyned to a long fillet of fat, which was extended to the whole length, and at the side of the body of the *Vertebra*, it was two lines broad.

The *Heart* which was found dry and without water in the *Pericardium*, was in proportion much greater than in any Animal, containing six inches in length, and four in breadth towards the Basis, and ending in a very sharp point. Its Substance appear'd to us very soft, before it was opened; but it was discovered that this proceeded from its being lean; and hollow, its *Ventricles* being so ample, that the left one which descended into the *Cuspa*, left but two lines of thickness in the flesh which covered it at this place; towards the Basis it had but seven, and the *Septum* had almost as many. The *Auricles* of the *Heart* were so small, that the Right, which is the greatest, was not half an inch. The Structure of the *Heart* of *Catts* is not so particular, for it is more obtuse at the *Cuspa* and fleshy than ordinary. The Proportion of the Branches which the Ascendent *Aorta* emits was such, that the *Carotides* contained the same thickness as the left *Subclavian*, and as the remainder of the Right from whence they do arise; which is very considerable in respect of the smallness of the *Brain*. The same thing is observed in *Catts*, excepting that they have a great deal more *Brains*, in proportion to their Bigness.

The *Brain* exceeded not two Inches every way. It was included in a

Cranium about half an Inch thick in the thinnest place, and almost an Inch in the Fore-head. The *Crown* was elevated like the *Crest* of an *Helmet*, to give rise to the *Muscles* of the *Temples*, which do cover the Two sides of the *Crown* of the Head, and in the middle of the fore-head do leave that Cavity, which *Aristotle* in his *Physiognomy* adjudgeth to be peculiar to *Lions*. Every of these *Muscles* was five inches in length, four and a half in breadth, two in thickness, and Twenty Ounces in Weight. This *Head* thus Garvished with *Flesh*, and Composed of *Bones* so firm in their structure and Substance, made us to think that if the *Bear*, according to *Pliny*, has a *Head* so tender and weak that it may be Slain with a slight Blow, it is probable that it would be very difficult to stun a *Lion*; and that this was well known to *Theocritus*, who tells *Hercules*, that all that he could do to the *Nemean Lion* with his Club, was to stun him, and that he could not kill him but by Strangling him with his Hands.

The *Bone* which is found in Brutes between the *Cerebrum* and *Cerebellum* over the *Sutura Lambdoides*, was an Inch and a half long, Ten lines broad, and Two thick, of a squarer Figure than that which is in the *Skull* of *Cats*, *Dogs*, &c.

The *Glandula Pinealis* was diaphanous, and so small that it exceeded not a line in length, and two Thirds of a line in breadth at its Basis.

The *Optick Nerves* appeared much thicker after their Conjunction than before: Which proceeded hence that the *Foramina* thro' which they do enter into the *Orbita* are not round, but like a slit; which makes them broader by flattening them. Being past thro' the *Foramen* of the *Orbita*, they were extended to the *Globe* of the *Eye*, two Inches and a half in length. It was observed that the *Cavity* of this *Orbita* was not wholly fenced with a *Bone* on the inside, but that there was a hole towards the *Temples*, between the *Apophysis* of the *Os Frontis*, and that of the first bone of the *Jaw*, which were not joyned more than in *Cats*, *Dogs*, &c.

The *Globe* of the *Eye* was sixteen lines Diameter. The *Cornea* was about the third part of a line in thickness at the middle, and grew thicker towards its Circumference; till it came to half a line, after the manner of the glasses in *Spectacles*.

The *Iris* was of that pale colour, which is called *Isabella*.

The *Tunica Choroides* appeared of a Gold-colour, and which had nothing of that Verdure, which most Authors do give to the *Eyes* of the *Lion*. The *Reverse* of the *Anterior Vnea* in the Place it lyes upon the *CrySTALLINUS*, was all Black. The *CrySTALLINUS* was found very flat, and its greatest Convexity, contrary to what is in other Animals, was in its antierour part; which is also observed in the *Eyes* of *Cats*. The *Figurs* of the *CrySTALLINUS* was such: that it seemed shrunk up having a Dent in the side, which made the *CrySTALLINUS* of the left *Eye*, where this dent was the greatest, like the *Forme* of an *Heart*: But one of these *CrySTALLINUS*'s which began to be spoilt by a *Glaucoma*, made us to suspect that this was *Præternatural*, and particular to our Subject. The *Aqueous Humour* was found very abundant, so that it almost equal'd the sixth part of the *Vitreous Humour*. This abundance was Judged to be the cause of the clearness which remained in the *Eyes* after *Death*, which are obscured when the *Cornea* is dried and contracted for want of this *Humour*, which keep's it extended.

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The last Observation was, that considering the Season which was hot and moist, when this Dissection was made, and the disposition to Putrefaction which must needs be in the body of an Animal Dead of a Disease, and which all Authors report to have a breath so stinking, that it infects whatever it approaches, to such a degree that other Animals do not touch the remainder of the Flesh wherof he has eaten; yet there appear'd nothing to us which denoted any extraordinary Corruption, its smell being less offensive than that of a *Deer*, which must be embowelled soon after it is killed. And altho' there were found some *Wormes* in its Flesh the fourth day, it was judged that they were 'ngender'd of *Phlegm*, because that a piece of the *Tongue* wrapt up in Paper was cloyed in the space of one night, and was grown very hard without any smell. Which made us conclude, that if the *Lion* is subject to a *Feaver*, it is not caused by the Corruption of Humours, and is only an *Ephemeris*, altho' it is said that he has it all his life: This may cause a Belief that Choller is a Balsome in the body of Animals which resists Corruption, and which has this effect, that *Lions*, in whom it is predominant, do live a long time.

There was likewise made another reflection upon the smallness of the *Brain* of this Animal, of which Natural Historians do relate so many marks of Judgement and Reason; and by comparing it with the abundance of that of a *Calfo*, it was judged that the littleness of *Brain* is rather the sign and cause of a savage and cruel Disposition than a want of Judgment. This conjecture was fortified by an other Observation which was made four dayes before upon a *Ses-fon*, where was found hardly any *Brain*, altho' it was thought that the Sagacity and Subtletie which it hath, has given it this Name amongst *Fishes*, all the Kinds of which are generally ill provided of *Brain*, so that they have little disposition to the Society, and Discipline which Terrestrial Animals are capable of.



THE
ANATOMICAL DESCRIPTION
OF ANOTHER
LYON.

THis *Lyon* was extraordinary large, though very young. It was seven Foot and a half long, from the end of the Nose to the beginning of the Tail, and four Foot and a half high, from the top of the Back to the ground.

Our Observations were almost the same, with those which we have already made on the first *Lyon*, but amongst other things, the straitness and narrowness of the *Thorax*, which we have already remarkt, seem'd to us very considerable in this Subject: For in the inside, from the one side to the other in the largest place, it exceeded not seven Inches, of which the *Heart* took up four, so that there remained but three for the *Lungs*, *Pericardium*, *Mediastinum*, and Vessels of the *Heart*. The *Pericardium* was likewise without Water, and the *Intestines* short in Proportion to the Body, containing but Twenty five Foot in length, which was just three times the length of the Body. The *Crystallinus* was more convex on the outside than the inside.

What we found different is, that the *Liver* which was of so dark a Red in the first *Lyon* that it appeared Black, was so pale in this that it had a *Fevile-morte* Colour.

That the *Annular Cartilages* of the *Larynx*, which were intire in the first *Lyon* which nevertheless was not Old, were found imperfect in this which was Younger. And we were not able to resolve whether we ought to attribute to the difference of Age, that which we observed in the Paws, because that in those of the Young *Lyon* we found the Skin much less hard, and firm then the other, so that at the extremity of every Toe of the Young one, it was so loose and flaggie, that it might be made to extend and descend to cover half the Nail: Which seems to be the case of which *Pliny* speaks. But the Truth is that there is no probability that this can preserve its Nails, as this Author Reports, because that they use them only at the Point, which this Skin cover's not.

We likewise observed something new, *viz.* That the *Epiploon* which was as great and large as its internal Membrane, and which immediatly touched the *Intestines*, did invelope them, and came round even to the *Kidneys*, having only the upper Membrane loose, as the Name of these Membranes

signifies. We farther remarked that their Substance was not properly a continued Membrane, but pierced by the light, and like a Texture of very fine Fibres making a Gauze.

That the *Kidney*, which was four inches long and two and a half broad was sprinkled on its External Superficies, with a great many Vessels covered with the Proper Membrane of the *Kidney*.

That the *Lungs* were spoilt, dry, pale, and full of Knobs. That in the *Eye*, the *Iris* was Visibly plaited with some circular wrinkles, which were the effect of the dilatation in the *Pupilla*, happened by the constriction of the Membrane which made the *Iris*. This folding is a thing which is commonly supposed, but which is not perceived without difficulty: And it was so much the more strange in this Subject, that the *Aqueous Humour* being very abundant, this Membrane was not Subject to contract by dryness. The *Vitreous Humour* was almost as fluid as the *Aqueous*. The *Tapetum* of the *Vnea* was Gilded through the middle as in the other *Lyon*, but it had a Verdure at the Extremities, which we found not in the other, although we thought it was to be there, by Reason that the Ancients did call the Eyes of *Lions* *χρυσῶν* that is to say, full of Ornaments, because that they found that green Eyes were most Beautiful.

The *Retina* was White and Opake enough, to make one think that it would hinder the reception of the Species, if it is True that they do pass farther.

The place where the Sight is commonly made, was crossed by a Vessel filled with Bloud, which passed also into the *Optick Nerves*, where it made a Cavitie, and seem'd to form that *Pore* or *Ductus*, with which some Authors do think, that the *Optick Nerves* were pierced, to give passage to the Spirits which are received into the *Brain*.

The Observation of the Vessels which are Visible and in great abundance on the Superficies of the *Parenchyma* of the *Kidney*, which is a thing extraordinary, affords us Matter for Two Reflexions; the first of which is, That these Vessels, which are Branches of the Trunks of the *Arteria* and *Vena Emulgentes*, do easily discover to the Eye, a Truth which we have already found in some humane Subjects, by the injection of Milk into the *Vasa Emulgentia*, after the having taken from the *Kidney* its proper Membrane. This Truth is that the Branches of the *Emulgents* do not terminate in the Middle of the *Kidneys*, as *Higmoreus*, following *Vasalius*, has thought; But that they are carryed to the external Superficies: For the separation of the *Urine* which must be done by *Filtration*, requires that the Blood be carryed thro' the *Arteries* as far as is possible, to the end that it there find a greater Thickness of the *Parenchyma* of the *Kidneys* to penetrate, and consequently more capable of making a more perfect *Filtration*.

The other reflection is, that those Vessels, which are not generally visible in the *Kidney*, whose Substance appears Solid and Homogeneous, towards its external Superficies, which was smooth and even, were found very apparent in this Subject. And we thought it probable that this happened by some distemper, and was Præternatural in this Animal: Either by an Inflammation, or Obstruction, which had caused these Vessels insensibly to dilate; This being easie in a young Animal, where the parts not yet hardened, are more easie to dilate, and the Humours being more agitated
are

are more capable of effecting this dilatation. *Glisson* who has observed that oftentimes the Branches of some Vessels are bigger than the very Trunk which produces them, says that this may be caused by a distemper: And experience daily demonstrates by the Pullation which happens in Inflammations, by the *Glandes* which appear in the *Scrofula*, and by the Veins which discover themselves in the *Eyes* by the *Ophthalmia*, that there is a great many things which a Distemper renders visible and sensible, by augmenting them, or changing their Nature, and making them to become hard and dense, from soft and rare as they were. Which we have observed in the *Glandes* which in some *Gazellas*, or *Antelopes*, have seemed to make the *Parenchyma* of their Liver, which appeared not in others.

We vainly fought in the Stomach and Lungs of our *Lyon*, some Marks of the cause of its Death, which was told us happened after the voiding a great deal of Blood thro' the Throat. But we judged by several Circumstances, which have been related, that a Surfeit extraordinary and insupportable to an Animal otherwise weakened, had made him sick: For we know that sometime before his Death, he was several months without going out of his Den, and that it was hard to make him Eat. That for this reason some Remedies were prescribed to him, and amongst others the Eating only the Flesh of young Animals, and those alive. And that those which look't to the Beasts of the Park of *Vincennes*, to make this Food more delicate did use a method very extraordinary; which was, they feed Lambs alive, and thus they made him to Eat several; which at the first revived him, by createing him an Appetite, and making him brisk. But it is probable that this Food ingendered too much Blood, and which was too subtil for an Animal to whom Nature had not given the industry of fleaing those which he Eat: It being credible that the Hair, Wooll, Feathers, and Scales which all Animals of Prey do Swallow, are a seasoning, and necessary Corrective, to prevent their greediness from filling them with a too Succulent Food.



The Explanation of the Figure of the LYONNESS.

THe Posture is such, that it is easie to Remark what is most Particular in this *Lyonness*. The Head is side-ways, the better to demonstrate the length of her Chops, which was not short and well-set like the *Lyons*. It do's likewise more distinctly shew the smallness of the Neck, which made the Head to be shrunk between the Shoulders.

In the Parts which the Dissection discovers.

- A. The Pylorus.
- B. The bottom of Stomach separated from the rest, and making as it were an other Ventricle, such as is in Animals which chew the Cud.
- C C. The Vena Gastrica.
- D. The Spleen.
- E E. The several Eminencies towards the Basis of the Heart, composed of a hard and tenacious Substance, which did not resemble Fat.
- F. The Trunk of the Vena Cava.
- G G. The Trunk of the great Arterie.
- H H. The Vasa Spermatia preparantia.
- I I. The Testicles.
- K K. Two Appendices, which appear to be the Fringes of the Tuba of the Matrix.
- L. The Matrix.
- M M. The Cornua Uteri.
- N. The Neck of the Matrix.
- O. The Bladder.
- P P. The round Ligaments of the Matrix.
- Q. The Membrane which composes the Iris, making several circular foulds.
- R. The place of the Tunica Conjunctiva, which is white.
- S. The place of the Tunica Conjunctiva, which is black.
- T. The Membrane which makes the inward Eye-lid.
- V V. The Claw.
- X X X. The last Bone, to which the Claw is fastened.
- Y. A Cartilagineous and Ligamentous Substance, which is between the Bone and the Claw, and which fills the space which is between both.
- a b c. The Matrix of a Woman, in which, a, represents the Fundus Uteri. b c, and b c. The Cavity which was in each of the Horns.

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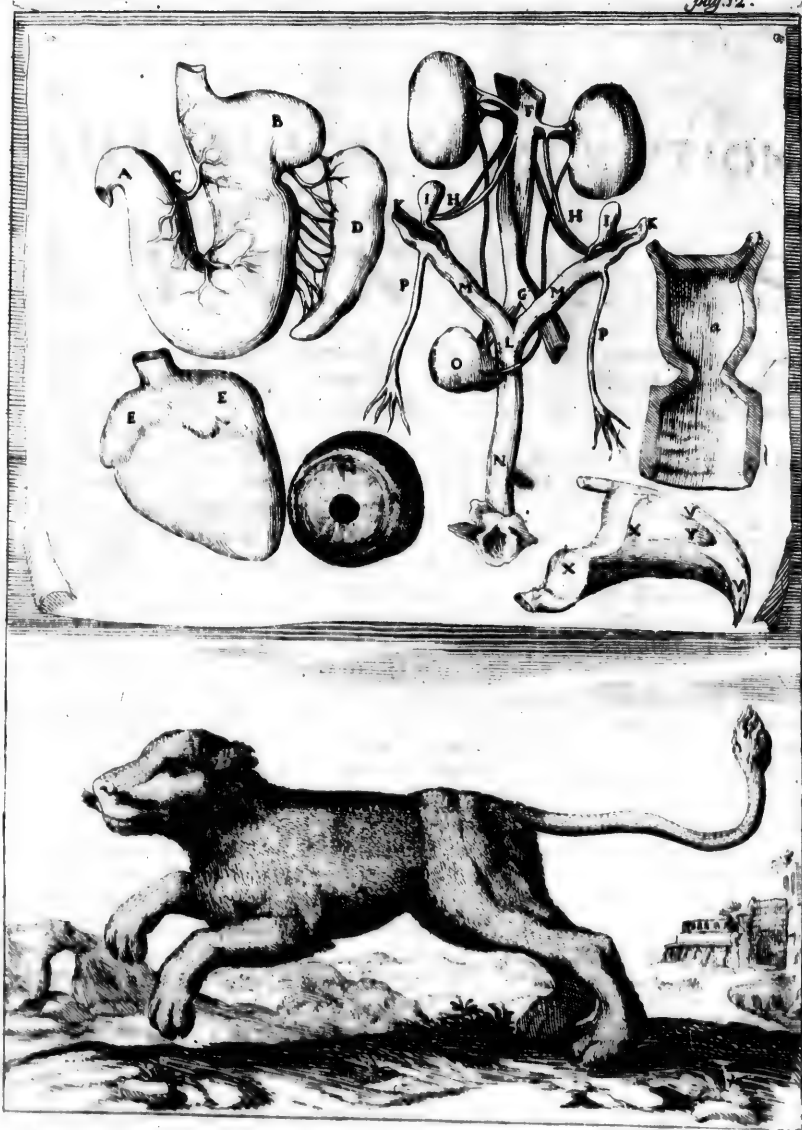
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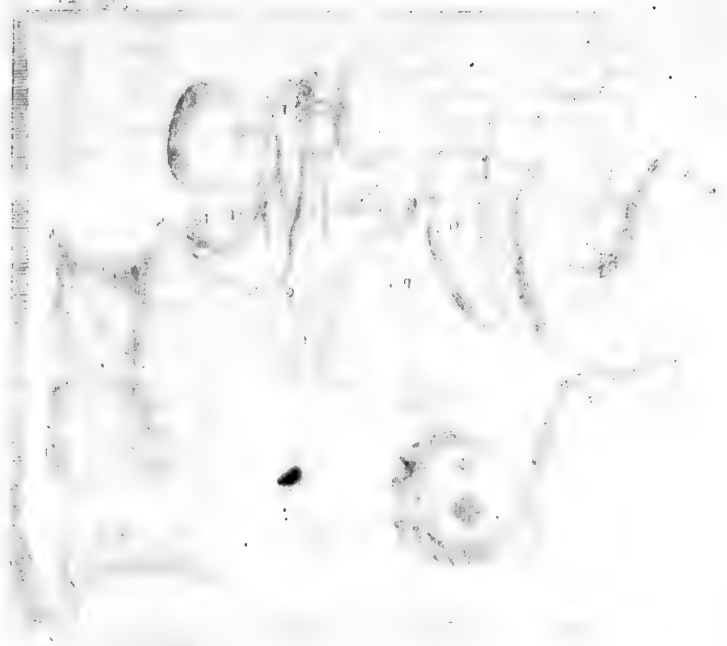
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T H E
ANATOMICAL DESCRIPTION
O F A
L Y O N N E S S.

BEfides the particular Character of the Sex of the *Lionness*, which is to have no long Hair about the Neck, there are observed several others, which are, that she has a longer Nose, a Head flatter at top, and Claws lesser than the *Lyon*.

This *Lionness* was three foot high from the end of the fore Claws, to the ridge of the Back. She was about five foot long, from the extremity of the Nose to the beginning of the Tail, which was two foot and a half long.

The Claws which were at the end, and divided into several *Fibres* like those of *Lions*, have been observed in this Subject with more care and exactness than in the others. It is observed that they are composed of a *Fibrous* and very compact Substance; in respect of each *Fibre*, but that these *Fibres* are easily separable one from the other; which happens, as it is easy to Judge, for want of the Moisture which should join, and glue them together; even as it is seen in *Fibrous* Wood, which cleaves not so easily before it is dry. Indeed this *Lionness*, which was extraordinary lean, had Claws much easier to shoot out than the other *Lions* which were younger and fatter. Thus the Root of the Claws, and the particular manner whereby we have found them fastened to the Bones of the ends of the Paws, has seemed to us to be principally to supply the humour which is necessary to these parts. For the Claw was not immediately fastened to the Bone by its whole Root: But there was a part thereof *viz.* the inside which was hollow, which was not knitt to the bone. This inside was filled with a competent substance between the *Cartilage* and ligament. This manner of connexion and fastening of these Claws seem'd to us to afford what ever is requisite to their use: For if all the *Fibres*, whereof these Claws are composed, had taken rise immediately from the Bone, they could not attract humidity enough to make that connection, which renders the Claws solid: And if they had been all fastened to the Bone by means of the *Ligaments*, they would not have been so strongly joyned, as when they are foddered without any thing between.

The Conformation of the Stomach was particular, and very different in this Subject, from that which we have found in other *Lions* which we have dissected, where the Stomach was like to that of *Dogs* and *Cats*, having an ample and large *Fundus* towards the superiour *Orifice*, which alwayes grew les-

fer and lesser towards the *Pylorus*; but this had the bottom parted in two in a manner like Animals which chew the Cud. This particular form of the *Ventricle* was found only in one of the four Animals of this kind which we Dissected, viz. two *Lions* and two *Lyonesses*: For in the two *Lions*, and the other *Lyoness*, the Stomach was like that of *Dogs*. It is very true that the Stomach of the first *Lion* had two *Protuberancies* in its upper part; but this was not considerable nor comparable to the division which made this Stomach double, and separated into two Cavities.

The *Intestines* contained in all twenty two foot four inches in length; the *Rectum* had but four inches, and the *Colon* two foot.

The *Colon* had no little cells, but only a straiter part, which divided it as it were into two parts, one of which was a little longer than the other. The *Cacum* was two inches long, and its *Fundus* upwards, and *Orifice* downwards. The *Pancreas* resembled that of *Dogs*.

The *Mesentery* was covered with livid Glands about the bigness of a Pea, all of an oval Figure. The *Vessels* were very apparent, and greatly dilated, and especially the *Veins*. There was very distinctly seen the *Vena Lactea*, divided in different Branches, by which the Trunks were easily carried to the *Pancreas Asellii*.

The *Pelvis* of the Kidneys was filled with a reddish Glare, which might have caused a reflux of Serosity, of which there was found a great deal in the lower *Venter* and *Thorax*.

The *Bladder* was so small, that tho' it was extended as much as it was possible by filling it with Air, it was not bigger than one of the Kidneys. *Aristotle* and *Ælian* do say that *Lions* do seldom drink. And *Albertus* Remarks, that *Lyonesses* do not long suckle their Whelps, for want of that abundance of moisture, which is necessary to the generation of Milk.

The *Liver* had seven lobes, six great and one small one. One of the largest which are placed on the right side, was split in two, and dilated as it were to make room for the right Kidney, which was higher than the left, as is usually in Brutes. The *Gall-bladder* was *Anfractuosa*, and formed like several *Protuberances*, as in the three other Subjects.

The *Spleen* was long, and like a *Crescent*. The branches of the *Vas breve*, which fastened it to the bottom of the *Ventricle*, were larger and more numerous than ordinary.

The *Uterus* was divided into two long *Cornua* as in *Dogs*. These *Cornua* were tied and fastened by large Ligaments. At their extremity, adjoining to and underneath the *Testicles*, there were some *Appendices* of an irregular Form, and as it were torn at the end, which were thought to be the parts which modern *Anatomists* do call the *Fringes* of the *Tuba Uteri* in Women: Which seems to justify and clear the Antients from an Error whereof they were accused. For this demonstrates that they had some reason to think that the *Cornua Uteri* in Brutes are the same thing with that called the *Tuba* in Women. For tho' the *Cornua* of Brutes be a hollow body, in which the Conception and Nourishment of their Young ones use to be made, and that the *Tuba* of Women appears solid and without Cavity, so that it is proper to receive the Seed, and make the *Transfuculation* into the *Fundus Uteri*, by possessing the place of the *Prostata*, according to the opinion of *Gallen*; and that the Conception be generally made in the *Fundus Uteri*; yet it is very true to say

say that the structure and use of the *Tuba* in Women, and the *Cornua* in Brutes, have nothing essentially different; seeing that as there are some Examples of the Conception made in the *Tuba*, we have some Observations which do manifest to us, that this *Tuba* has sometimes also an evident Cavity. We have here put the Figure of the *Uterus* of *Tottian*, in which we found two apparent Cavities, which made some windings eight Lines long, and near two broad at their beginning, which from the *Fundus Uteri* did Penetrate into the *Tuba*.

At the end of each of the *Cornua*, a little below the *Testicle*, there was a long Body, of a Nervous Substance, which was taken for the *Ligamenta Tere-*
tia: For it descended into the *Groyn*e, and was there dilated like a Goose's Foot as in Women. Its original was only different in this, that in Women these Ligaments proceeded from the very Body of the *Uterus*, at the place where the *Tuba* began, a good distance from the *Testicle*. *Soranus* Writes, that he had seen in a Woman this round Ligament, which he calls the *Cremaster* of the *Testicle* of Women, which was fastened near the *Testicle*, even as we have Observed in our *Lyonness*.

The *Mediastine* was not pierced like a Net as in the first *Lyon*; but its *Mem-*
brane was thick and continued.

The *Lungs* had seven Lobes, three of each side and one in the middle; Those of the right side were larger than those of the left. The whole *Par-*
enchyma of the *Lungs* was scirrhus. The *Vena Coronaria* was very large; but the *Heart* was much less than in the two *Lions* which have been dissected. The inside of the left *Ventricle* was scirrhus towards the mouth of the *Ar-*
tery of the *Lungs*; and it seemed that the *Lungs* had communicated this Dis-
temper to the *Heart*. There were two *Polypus*'s, one in each *Ventricle* of the *Heart*. All the Basis of the *Heart* on the out side, was surrounded with a slimy Substance; which formed several unequal *Pectuberancies*, instead of the *Fat* which is commonly found in this place.

The *Tongue* was armed, as in the *Lions*, with great points like *Claws*; they were lesser, softer, and blunter.

The *Ventricles* of the *Brain* were very large; and the *Cavity* where the *Fals* enters, and which divides the *Cerebrum* in two, was likewise very deep, containing ten Lines. The *Glandula Pinealis* was exceeding small, not exceeding a Line.

The *Chrystalline Humour* like as in *Lions*, was more convex before than behind; which was not found in the other *Lyonness*, where it was flat and more convex behind. The *Membrane*, which is put into the bottom of the *Eye*, and laid on the *Choroides*, which we call the *Tapetum*, was of an *Isabella* Colour, intermixt with a brisk *Greenish Blew*. It was easily separable from the *Choroides*, which remained intire with its ordinary thickness, after that we had taken away the *Membrane* which forms this *Tapetum*.

The *Optick Nerve* was near the *Axis* of the *Eye*. In it's middle there was seen to appear a *Foramen*, which disappear'd when the whole *Retina* was layd on one side, and that it was not equally extended about the *Optick Nerve* on the Concavities of the *Choroides*.

The

The Explication of the Figure of the CAMELION.

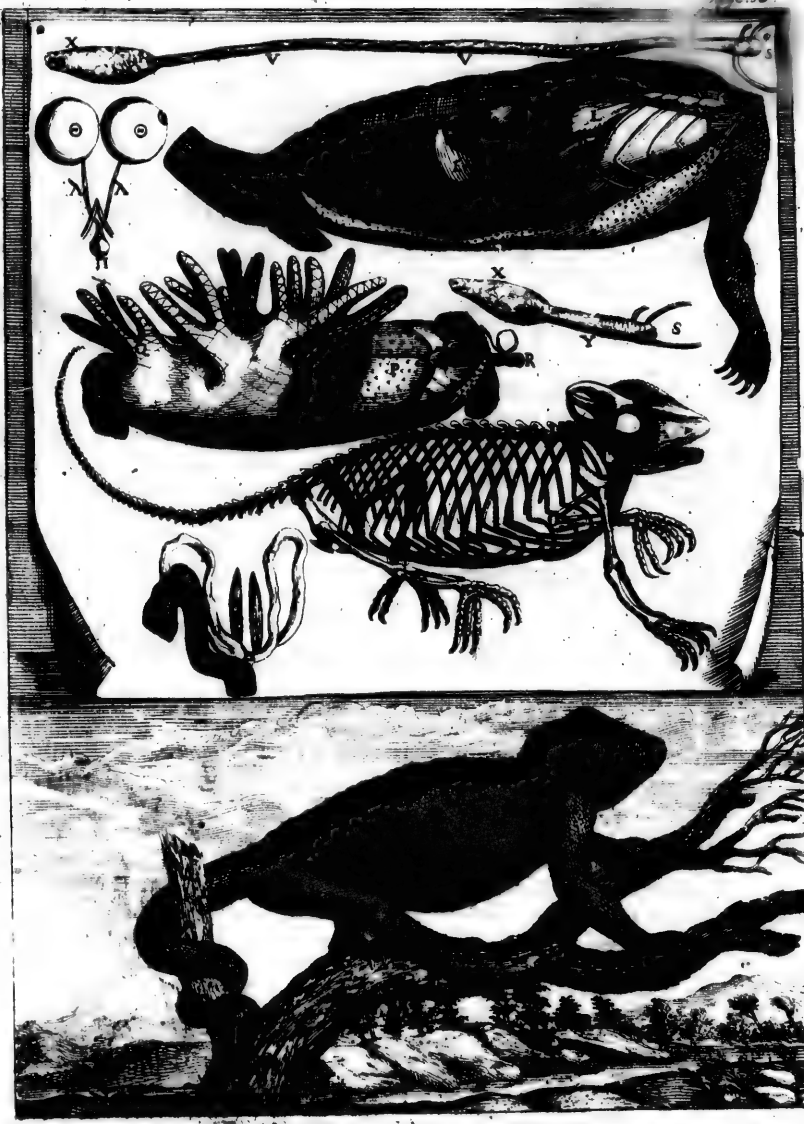
IT is represented alive, perched on a Tree somewhat crooked towards the side which it ascends, to discover as much as is possible, the top of the Head, and bottom of the Belly.

In The Parts which the Dissection discovers.

- A. *The Gall-Bladder.*
- B. *The left Lobe of the Liver.*
- C C. *The right.*
- D. *The Oesophagus.*
- E. *The Ventricle.*
- F. *The Pylorus.*
- G. *The Ductus Cholidocus.*
- h. *The Vena Porta.*
- I. *The Vena Cava.*
- K K K. *The Intestins.*
- L M. *A Membrane which held all these Parts links together and suspended.*
- N. *The first Bone of the Sternum.*
- O. *The left Lobe of the Liver.*
- P. *The upper part of the Lungs blown up, and speckled with red Spots.*
- Q Q Q. *The rest of the Lungs blown up.*
- R. *The Aspera Arteria tyed to keep the Lungs blown up.*
- SS. *The Os Hyoides.*
- T. *The Cartilaginous Stylus, to which the Trunk which sustains the Tongue, is fastened.*
- X X. *The Tongue.*
- Y. *The Trunk drawn up.*
- Z Z. *The Kidneys.*
- Γ Γ. *The Cornua Uteri.*
- Δ. *The Neck of the Uterus.*
- K K. *The Intestines.*
- Θ Θ. *The Eyes.*
- λ λ. *The Optick Nerves.*
- Π. *The Brain.*

We did not think that the Skeleton needed any Explication, by reason of the Neatness of the Figure, and the exactness wherewith it is described in the Discourse.

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THE
ANATOMICAL DESCRIPTION
OF A
CAMELION.

There is scarce any Animal more Famous than the *Camelion*, its admirable Properties have ever been the Subject as well of Natural as Moral Philosophy. The changing of its Colour, and the particular manner of feeding which is attributed to it, have in all Ages given great Admiration and Exercise to those that do apply themselves to the Knowledge of Nature: And those Wonders which Naturalists have related of this inconsiderable Animal, have made it to be the most Famous Symbole used in *Rhetorick* and *Ethicks*, to represent the base compliance of Courtiers and Flatterers, and the Vanity wherewith simple and light Minds do feed themselves. Its very name in *Tertullian* is the Subject of a Serious Meditation upon False-glory, and he proposes it as the Example of the Impudence of Cheats and Boasters.

It is not known truly why the *Greeks* have bestowed so fine a Name, upon so vile and ugly a *Beast*, by calling it the *Little-Lyon*, or *Dwarf-Lyon* according to *Isidore's* Etymology. *Gesner* says, that it somewhat resembles the *Lyon*, without mentioning wherein. *Panaxolus* would have it the Tail which is crooked at the end, as he says, like the *Lyons*: But the Truth is, that neither the *Camelion* nor the *Lyon* have a crooked Tail. It would be more probable to place the Resemblance on the *Crest*, which they both have on the Top of the Head, which makes a kind of Casque: But it appears on the *Lyons* Head only, when the Flesh of the *Musculi Crotophite* is cut off, *Licetus* thinks that this Name was given it, because as the *Lyon* Hunts and Devours other Animals, so the *Camelion* catches Flies; by the same reason that a little *Worm* which Hunts and takes *Ants*, as *Albertus* hath described, is called *Formicaleon*; and that a little *Loyster*, as *Pliny* and *Athenens* report, is named *Lyon*, because it is of the same Colour.

The *Camelion* is of the kinde of four-footed Beasts, which do lay Eggs, as the *Crocodile*, and *Lizard*, which it sufficiently resembles, save that its Head and Back is not flat like the *Lizards*, who has likewise much shorter leggs, with which it crawls very fast along the ground: whereas the *Camelion* has longer leggs, and goes easily only upon Trees, where it delights it self much more than on the ground; because, that as it is sayd, it fears the *Serpents*, from which it cannot secure it self by flight, and that from thence it spies them,

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watching the opportunity when they do pass, or Sleep under him, to Kill them with his Foam which he lets fall upon them.

Belonius has observed two Species of *Camelions*, one whereof is found in *Arabia*, the other in *Egypt*. *Faber Lynceus* adds a Third, which is in *Mexico*. That which we describe is the *Egyptian* one; which is the greatest of all: For those of *Arabia* and *Mexico*, are not ordinarily more than six inches long, and ours which was brought us alive was in all, comprehending the Tail, eleven Inches and a half in length; *Pliny* is greatly mistaken, when he makes the *Camelion* as big as the *Crocodile*, which is the biggest of all Animals: or if he intends to compare it to the *Land Crocodile*, he deceives his Reader, for that is less known than the *Camelion*, and whereof no body has spoken but himself, or upon his Report. *Salmasius* attributes this Fault to the ill Translation which *Pliny* has made of the Book, which *Democritus* writ of the *Camelion*; in which, according to the *Ionick Dialect*, the *Crocodile* is called by the Name which commonly signifies the *Lizard*. The Head of ours was an Inch and ten Lines; from the Head to the beginning of the Tail, it was four Inches and a half; the tail was five; and the Feet were each two Inches and a half long. The Bulk of the Body was found different at several times: For sometimes it was two Inches from the Back unto the under part of the Belly; at other times it was scarce above an Inch, according as it swelled or contracted it self; this swelling and this contracting was not only in the *Thorax* and Belly, but it reached even to its fore and hind-legs, and its Tail. This particular Circumstance, which *Aristotle* has observed, makes us to think upon what *Theophrastes* says of the *Camelions* Lungs, viz. That they do extend thro' the whole Body.

Now these contrary Motions of swelling and contracting are not done as in other Creatures, when to breath they dilate their Breast, and presently contract it successively and orderly; for we have seen it puff up above two Hours, during which time it abated a little, but very imperceptibly, and swelled again a little, but with this difference, that the Dilatation was more suddain and visible, and that by long and unequal intervals. We have likewise seen it continue unswelled for a long space, and much longer than swelled. In this Condition it appeared so lean, that the *Spine* was sharp, as if by the extenuation of the *Muscles* which are without along the *Vertebra*, the Skin was fastened upon the spinous and oblique *Apophyses*; which discovered three Eminencies. The Ribbs might be counted, and the Tendons of the fore and hind-legs appeared very distinctly to the Eye; But neither the *Vertebra*, like a Saw, which *Gesner* and *Landius*, do in *Sealiger* report were seen on the Back, nor the *Pricks* which *Panarolus* saith were placed there by Nature for its defence, appeared to us: how lean soever it grew, its back only remained sharp and keen, without being jagged or having any Points; the *Apophyses* of the *Spine* being square at the end, as in the generality of Animals. This lankness was known likewise when it turned its Body; for it seemed like an empty Sack that is twisted; which *Tertullian*, who was of the same Country with our *Camelion*, had very well observed, when he says, that this Animal was but a living *Skin*.

This *Skin* was very cold to the touch; and notwithstanding the great lankness I have been describing, it was impossible to feel the beating of the Heart, which was more secret and obscure than the motion of its Breathing.

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The *Superficies* of the Skin was uneven, and raised in little Eminencies like *Chagrine*, being nevertheless very soft to the touch, because that every Eminence was very smooth: These Eminencies or Grains were of a different size; the greatest part were like the head of a middle-sized Pin, viz. The Grains which covered the fore and hind-legs, the Belly and Tail: There were others somewhat bigger, of an oval Shape, upon the Shoulders and Head; and some of these large Grains were higher and more pointed, to witt, under the Throat, where they made a Row like Beads, which reached from the lower lipp to the Breast: The Grains which were upon the Back and Head, were joyned and heaped together, sometimes to the Number of Seven, sometimes Six, Five, Four, Three and Two; leaving between these different heaps, some distances covered with other little Grains almost imperceptible, which were generally of a pale *Red*, and *Yellowish* like the bottom of the Skin which appeared between these parcels of Grains. This Ground changed not Colour till the Animal was dead, at which time the little Points grew whiteish, and the Ground whereon they were sowed, changed its *Red* into a *Dark-Gray*.

It has been since found, that all these Grains, as well the great as the little ones, were made by the Skin which swelled outward, being hollow on the inside in the place of every Grain, like plates of Metal which are chased or stamped; in part also thro' several little Pellicles very slender, and lying one upon another, which increased the thickness of every Eminence; which were easily raised, when they were scraped with a Penn-knife. But all this would not make the Skin resemble that of a *Crocodile*, as *Aristotle* with most Authors would have it. For the *Crocodile* has upon its Back, very large thick Scales, proportionable to those under its Belly; and they are ranged one upon another; whereas the Eminencies of the *Camelion's* Skin, are spread without Order, and little differing in size.

The Colour of all the Eminences of our *Camelion* when it was at rest in the shade, and had continued a long time untoucht, was a *Bleuish-Gray*, excepting under the Paws, which was a *White* inclining to *Yellow*, and the Interval of the Heap of Grains, which was of a *Pale* and *yellowish Red*, as aforesaid: And it is probable, that the natural Colour of the *Camelion's* Skin, which according to *Aristotle* is *Black*, was in ours that *Gray* which covered the Skin all over when in Repose, and which remained on the inside of the Skin when excoriated: Though the out-side had sometime after its Death preserved, the Spots and different Colours which were there at the Minute it expired, but which were well near all obscured when the Skin was dried.

Now this *Gray* which coloured all the *Camelion* exposed to the Light, changed when in the Sun; and all the places of its Body which were enlightened, instead of their *Bleuish* Colour, took up a *Brownish Gray*, inclining to a *Minime*. The rest of the Skin which was not illuminated by the Sun, changed its *Gray* into several brisk shining Colours, which made Spots about half a Finger in bigness, which reached from the Crest of the Spine to the middle of the Back; others appeared likewise upon the Ribbs, fore-legs and Tail. All these Spots were of an *Isabells* Colour, through the mixture of a pale *Yellow*, where-with the Grains were coloured, and of a brisk *Red*, which is the Colour of the bottom of the Skin which appears amongst the Grains.

The rest of this Skin not enlightened by the Sun, and which was of a Paler *Gray* than ordinary, resembling Cloth made of *Mixt*-coloured Wooll: For some of the Grains were seen of a *Gray* somewhat *Greenish*, others of a *Minime Gray*, others of the common *Blewish Gray*, the ground remaining as before.

When the Sun did not shine, the first *Gray* came again by little and little, and spread it self all over the Body, except under the Feet, which continued of the same Colour, but a little *Browner*. And when being in this state, some of the Company handled it to observe something, there immediately appeared on its Shoulders, and fore-leggs, several very *Blackish* spots about the bigness of one's Nail; which happened not when it was handled by those that lookt after it: Sometimes it was marked with *Brown* Spotts, which inclined to a *Green*. We afterwards wrapped it up in a Linnen Cloath, where having been two or three minutes, we took it out *Whiteish*; but not so *White* as that of which *Aldrovandus* speaks, which was not to be seen, by becoming exactly like the Linnen on which it was layed. Ours, which had only changed its ordinary *Gray* into a very pale one, after having kept this Colour some-time, lost it insensibly.

This Experiment makes us question if it be true, that the *Camelion* takes all Colours except *White*, as *Theophrastus* and *Plutarch* report: For ours seemed to have such a disposition to receive this Colour, that it waxed pale every night; and when it was dead, it had more *White* than any other Colour. We did not find likewise that it changed Colour all over the Body, as *Aristotle* reports: For when it takes other Colours than its *Gray*, and disguises it self to go in Masquerade, as *Ælian* say's pleasantly, it covers only certain parts of its Body therewith.

Lastly, to conclude the Experiment of the Colours which the *Camelion* can take, it was lay'd on things of various Colours, and wrapped up there in; but it took not them, as it had done the *White*; and it took that only the first time it was made, although it was several times repeated on different Dayes.

In making these Experiments, we observed that there were a great many places of its Skin which grew *Brown*, but very little at any time. To be more certain thereof, we marked with little points of Ink those Graines which to us appeared most *White* when it waxed *Pale*; and we always found that when it grew *Brownest*, and its Skin spotted, those Grains which we had marked were alwayes less *Brown* than the rest.

Its Head resembled that of a *Fish*, being very closely joyned to the Breast, and by a very short Neck, which was covered on the sides, with two *Cartilagineous* risings, which resembled the Gills of *Fish*. There was a Crest erected just upon the Crown of the Head, and two other Crests over the Eyes, turned like an S longways. Between these three Crests there were two Cavities along the upper part of the Head.

Its Nose made an obtuse Point; and there were two Edges which reached from the Eye-brows to the end of the Nose, and which made it to resemble that of a *Frogg*. *Aristotle* says that it is like to the *Chæropithecus*, which is an unknown Animal, the Name whereof shews its derivation to be from an *Ape* and *Hæg*: But the Nose of our *Camelion* resembled neither that of the

Ape, nor of the *Hog*: for the lower Jaw stands out farther than the upper, which is quite different from the snout of a *Hog*.

At the end of the Nose there was a hole on each side like a Nostril. *Be-tonius* seems to be of opinion that these holes do likewise serve for the Hearing; and that so rationally, that *Almacon* sayd, by the report of *Aristotle*, that Goats do breath through the Ears, which is a thing *Ælian* says, ought to be believed only by the Goat-herds, altho' *Tulpius* in his Observations assures us, that in Man himself there is found a passage which conveys the Air into the Mouth thro' the Ears. The truth is, that our *Camelion* had no other holes in the Head but these two Nostrils, through which it is probable it breaths, because that its Mouth is commonly so closely shut, that it seems to have none, its two Jaws being joyned by an almost unperceivable Line, altho' *Solinus* Writes that its Mouth is always open: Which may make us to think that *Solinus*, and the generality of those which have described the *Camelion*, never saw one alive; for they do make the Mouth open, which is not usual but when it is dead.

These Jaws are furnished with Teeth, or rather with a dentillated or indented Bone, which to us appeared not at all serviceable to it in eating; because that it swallowed the *Flies*, and other Insects which it catched, without chewing them. *Ælian* says that it defends it self against the Serpent, by the help of a great Stick which it takes in its Mouth; and its probable that its Teeth may serve to hold it fast; but it is to be understood that it holds it cross-wise, to hinder the Serpent from swallowing him up, as it usually do's *Frogs* and *Lizards*, whole: For there is no possibility of explaining this place of *Ælian* as *Gesner* and *Aldrovandus* do, who think that the *Camelion* makes use of this Stick as of a Buckler or Sword wherewith it defends it self against the Serpent, as a Fencer would do; for it is not nimble enough for that.

The Mouth was slit after a peculiar manner: For whereas other Animals have generally the opening of the Lips, much less than that of the Jaws; the Lips of our *Camelion* were slit beyond the Jaw the length of two lines, and this continuation of the slit descended obliquely downwards.

The Form, Structure, and Motion of its Eyes had something very peculiar. They were very large, containing above five lines in Diameter. They appeared Spherical, jutting out full half of their Ball, which was covered with one single Eye-lid made like a Cap pierced with a hole through the middle, this hole not exceeding one line in breadth. Through this little hole the *Pupilla* which was brisk and clear, and surrounded as it were with a little golden Circle, was easily enough perceived, although *Aristotle* say's that this Circle cannot be discerned till after that the Eye-lid be taken away by Dissection. This Eye-lid was rough like the rest of the Skin; and when the body variegated it self into several Colours, making spots which were at different times of different Figures, those of the Eye always remained of the same sort; for the bars or streaks tinged with that Colour which came over the rest of the Body, parted from the hole of the Eye-lid as from a Center, and were extended towards the Circumference like rays.

The forepart of the Eye was fastened to the Lid, which neither raised nor shut down it self as in other Creatures, who can give their Eye-lid a different motion from that of the Eye, for that of our *Camelion* could not remove it self, but the Eye-lid followed its Motion. Which *Pliny* seems to express,

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but very improperly, when he says that the *sight* or *Pupilla* of the *Camelion* *stirs not*, but that it is the whole Eye which moves; for there is no Creature that stirs the *Prunella* when all the rest of the Eye stands still. But what is more extraordinary in this motion, is to see one of the Eyes move whilst the other remains immoveable, and the one to turn forward, at the same time that the other looks behind; the one to look up to the Skie, when the other is fixed on the Ground: And all these motions to be so extream, that they do carry the *Pupilla* under the Crest which makes the Eye-brow, and so far into the *Canthi* or Corners of the Eye, that the Sight can discern whatever is done justly behind and directly before, without turning the Head which is fastened to the Shoulders. *Aristotle*, who has described the *Camelion* more exactly than any other Animal, has omitted this particular circumstance of this extraordinary motion of the Eyes, which in truth is not found in the *Mexican Camelion*: But it is probable that is not that which *Aristotle* has described. He has not also observed that this little hole of the Eye-lidd closes by enlarging it self cross-wisely, even to the making one single slit, which very exactly unites the upper part with the lower; for he says that the sides of that hole do never joyn together to close the Eye. *Pliny* and *Solinus* do likewise averr the same thing, and almost all Naturalists, who have only seen *Camelions* in the Books of these Authors.

That part of the Body which is called the Trunck, and which comprehends the *Thorax* and Belly, was in our *Camelion* a *Thorax* alone, with scarce any Belly; which *Aristotle* hath better observed than *Pliny*, who say's that the *Camelion's Breast is joyned to its Belly*; for that is not peculiar to it, being so in all Animals, which have nothing between the Breast and Belly. But when *Aristotle* say's, that the *Camelion's Breast as in Fish, is joyned to the Hypogastrium*, which is the lower Belly, he clearly shews that the Ribbs do descend as low as the *Hia*, whereas other Animals have only the transverse *Apophyses* of the Loyns, the rest being Bone-less, and therefore by *Hippocrates* called *Void*.

Its four Feet were alike. They differed only in this that the foremost were bent backwards, and the hindmost forwards, and it may be said that these are four Arms which have their four Elbows bending inwards, every one consisting as it were of a *Humerus*, articulated with two Bones like to a *Radius* and *Cubitus*. *Solinus* is mistaken, when he says that the *Camelion's Feet* are Joyned to the Belly; for in ours those behind were articulated with the *Os Ischium*, and those before were fastened to the *Omoplatæ*.

The four Paws were every one composed of five Claws, and better resembled Hands than Feet. They, as well those before as behind, were divided in two; which made as it were two Hands to each Arm, and two Feet to each Leg: For though one of these parts had but two Claws, and the other three, yet they were as large as one another, the Claws, which were two and two being larger than those which were three and three. These Claws were closed together under one skin as in a *Mittin*, and were divided only in the last Joynt, to which the Nails are fastened. The disposition of these Paws was different, in that those that were before had two Claws outwards and three inwards, contrary to those behind, which had three outwards and two inwards.

With these Paws it caught hold on the little branches of *Trees* like a *Parrot*,

rot, which to pearch it self, divides its Claws different from other *Birds*, who do always put three before and one behind, whereas the *Parrot* puts two behind as well as before.

The Claws which were a little crooked, and very sharp, and of a pale Yellow, proceeded but half way out of the Skin; the other half was covered and hidden underneath: They were in all two Lines and a half long.

Its Tail well enough resembled that of a *Viper*, as *Pliny* observes, or that of a great *Rat*; which *Marmol*, who has Writ the History of *Africa* in *Spanish*, seems to intimate; when he compares this Tail with that of a *Mole*, because that the small resemblance that there is between the Tail of a *Camelion*, and that of a *Mole*, must make us to think that *Marmol*, according to the Custome of the generality, of those who publish the Relations of what they have seen in Foreign Countries, has without distinction intermixt what he hath Read, with what he hath Seen; and that he has taken what he speaks of the *Camelion's* Tail, out of some *Italian* Author, because that *Topo* which in *Spanish* signifies a *Mole*, does in the *Italian* signify a *Rat*.

But the Tail of our *Camelion* was neither like to a *Vipers* or *Rats*, save when its swelling made it round; for otherwise it had all along the three Eminencies which are seen upon the Back, as aforesaid, which are the rows of the *Spinous*, and *oblique Apophyses* of the *Vertebra*: Besides these it had likewise two other rows made by the *Transverse Apophyses*. It always wound this Tail about the Branches, and it served him instead of a fifth Hand. When it walked it very rarely suffered it to trail on the ground, but kept it parallel to the places where it went.

Its Pace was slower than that of a *Tortoise*, and seemed very Ridiculous, in that its Leggs being not short, and incumbered like those of the *Tortoise*, but very loose and free, it carried them with a kind of Gravity which seemed affected, because needless. Wherefore *Tertullian* saith, *that one would think that the Camelion rather made as if it would walk than that it really did.*

Some do think that this Gate is a Mark of the Timorousness, which is said to be very extream in this Animal. But because it is certain that Fear, when it is not great enough wholly to take away Motion, adds great Strength to that of the Leggs; into which it is believed that it makes all the Heat and Vigour, which has left the Heart to descend. It is much more probable that this slowness is the effect of a great Precaution, which makes it to Act circumspectly. For it seems that the *Camelion* chuses out places where it can best sett its feet; and when it climbs up Trees it trusts not to its Claws, tho' they are much sharper than those of *Squirrels* which do every where climb up so lightly: But if it cannot grasp the Branches by reason of their bigness, it seeks out the clefts or cracks which are in the Bark, to fasten its Claws therein.

HAVING opened our *Camelion* after it was dead, we found, when the Skin which covered the *Thorax* and Belly, was pulled off, that there was nothing underneath but Membranes which joyned the Ribbs together, and which were in the place of the *Musculi Intercostales*. These Membranes which were so transparent, that the Intrails might be seen through, were died green on the Liver.

The Belly being cut through the Middle up to the *Cartilago Xiphoides*, the Liver offered it self, out of which the Gall Bladder proceeded so as to touch the

the short Ribs; so we do call the Ribs which are not joyned to the *Sternum*, and which are after a particular manner in the *Camelion*, as hereafter shall be explained. We found the Vesicle between the Lobes; though *Belonius* placeth it in the left Lobe: It was a bout the bigness of a *Pea*, almost round, of a *Dark Green*. Its Neck produced the *Ductus Cholidocus*, which was inserted underneath the *Pylorus*.

The Liver which was of a dark *Red*, and of a pretty firm *Parenchyma*, in which several Cavities or Passages might easily be discerned, was divided into two Lobes, whereof the Right appeared somewhat Larger than the Left.

The *Ventricle* lay under the Liver, and seemed to be only the continuation of the *Oesophagus*, which enlarged it selfe a little in the Belly, along which it descended itraight enough, and was only a little bended towards the *Pylorus*, where it was contracted; and there its Membranes were very hard. We wondered how so itraight a passage made by so hard a Membrane, could give way to the flies, which were whole in the *Intestines*, and our Opinion was, that it must be that the *Pylorus* was capable of a distention like to that of the internal Orifice of the *Uterus*. This *Ventricle* was of the same Substance and Colour as the *Oesophagus*, both being composed of *White*, and not Transparent Membranes, as were all the rest that were found in the Belly. The *Oesophagus* and *Ventricle* were together three inches and a half long. At the passage out of the *Pylorus* the *Intestine* was enlarged, and grew bigger than the *Ventricle*, making three turnings one on the right side of the *Pylorus*, the second at the bottom of the Belly, where being descended, it rose again towards the *Ventricle*, where it made the third winding, to re-descend towards the *Anus*. The length of this whole *Intestine* was seven Inches, and it kept the same bigness to the end. It was very *Black* all over, and one might see certain Membranes where with it was fattened, which were the *Mesentery*, in which were likewise observed Vessels full of Blood. There were also *White Fibres* like the *Vena Lactea*; and this Membrane of the *Mesentery* which was very transparent, had in its middle a piece which grew thick and opaque, as it were to make the *Pancreas Asellianum*, or *Reseptaculum Pecquetianum*. Though it was impossible to get together the Branches of the Blood-Vessels spread in this *Mesentery*, and to trace them to their Trunk, yet there was seen one which was judged to be that of the *Vena Portæ*. The *Vena Cava* was likewise found under the Liver, lying upon the *Vertebra*, and full of very *Black* Blood.

There was no appearance of the Spleen: Which agrees with what Authors averr of the *Camelion*. They do say likewise that it hath no Kidneys: However we found, that our's had two Fleshy parts lying all along the two sides of the Spine, in the region of the Loyns and the *Os Sacrum*, which we took for the Kidnyes: These fleshy parts were easily seperated from that place on which they were fastened, that they could not be taken for the *Musculi Psoæ*; and they were firmly fixed only at the place, where the end of the *Intestine* joyned it self to the beginning of the *Uterus*. This particular circumstance made *Giffendus* to beleive that these fleshy parts, whereof he speaks in the life of Mr. *Pierisk*, who had the curiosity to keep *Camelions*, might be the *Testicles*. They were about an Inch long, near two Lines broad about the middle; and they went sloping to the end, making the figure of a Lancet. They were about the thickness of two thirds of a Line. Their

Parenchyma was of a pale Red very Solid, and watered within with store of Serositie; which made us to take them rather for the Kidneys than *Testicles*: And that which strengthened and confirmed this Opinion, was a Cavity each of them had in its middle, according to their length, formed of a very hard Membrane, which might pass for the *Pelvis* of the Kidney. *Malpighius* has observed the like passages in the Kidney's of *Birds*, which yet *Harvey* saith are Solid, and without any Cavity.

The *Uterus* had a passage which came out at the *Anus*. This Passage or Neck of the *Uterus* was placed on these Fleishy Parts, which we thought to be the Kidneys, and under the extremity of the Intestine as in *Birds*, and wholly contrary to what is usual in other Animals, where the Intestine is upon the *Os Sacrum*, and the Bladder above the Neck of the *Uterus*. This *Uterus* was as in Beasts composed of two Horns, which came out of its Neck, and extended three Inches and a half in length, and returned to the same place, making as it were two *Anses* or Handles when they were drawn from within the region of the *Iliac*, where they were folded up. They were not above a Line broad, and in several places less, where they contracted themselves, making as it were knots: But we found no Eggs neither in their Cavity, nor in the annexed Membranes, called the *Ovarium*.

The generality of all these Parts, viz. the Liver, Ventricle, and Intestines, were upheld and suspended by a strong Membrane or Ligament, which like the *Mediastinum*, descended from the Region of the *Cartilago Xiphoides* to the lower part of the Belly. There were also such like Membranes, which from the same Cartilage were extended on the right and left side, which were that which *Harvey* takes for the *Diaphragm* in *Birds*, and which *Fabricius* denies to be a *Diaphragm*, because that they are not Muscular. And indeed these Membranes were transparent, having no fleshy substance, they were only double, and joyned to several others differently figured, as it appeared when having blowed into the *Aspera Arteria*, both the great Vacuities on the right and left side of the Bowels, which hung in the middle, were suddenly filled by the swelling of those Membranes, which were not discerned before it was blown; and this swelling did not only fill these Cavities, but it did thrust out on both sides some productions resembling the Bladder of a *Carp*; some about the length and bigness of ones Finger, others much less, and from the great ones proceeded other lesser Productions. In the middle of these two great heaps of different productions of Bladders, which represented the right and left Lungs, there likewise arose one single Bladder, which seemed to supply the place of the little Lobe, which in a great many Animals is found in the middle of the Breast, in the Cavity of the *Mediastinum*. These Membranes thus extended by Air were White, and somewhat transparent, and appeared very curious; but they were strengthened by Fibres, inter-woven like Nets.

When we ceased to blow, all these Membranes falling down and lying upon one another, caused all these Bladders to disappear, which indeed are nothing else but the *Processus* of the Lungs.

Gesner saith, that of the *Intraills* of a *Camelion*, the Lungs only are visible. But *Aristotle* has more truly observed, that *Quadrupeds* which lay Eggs, have Lungs almost invisible; if they are not blown into to swell them. Indeed, whatever appeared in the place where the Lungs ought to be was, before it

was extended by blowing, but like two little pieces of *Rose-coloured* Flesh, about the bigness of a *Bean*, situated on each side the Heart; which made *Panarolus* to say, that the *Camelion* has little Lungs. But these little pieces of Flesh were not all the Lungs; they could be taken only for the Membranes of the upper part of the Lungs plaited and heaped together; which in this place were interspersed with small *Red* Eminences, which when the Wind dilated these Membranes, appeared all over the extent of their Superficies; and when the Membranes subsided these little *Red* Eminences approaching one another, caused again this appearance of Flesh, which was no spongy Substance, as *Panarolus* would have it, but only a heap of contiguous Membranes.

The *Aspera Arteria* was very short, composed, as is usually, of *Annular Cartilages*. It had a *Larynx* at its beginning, made up as it were of two *Epiglottides*, which shut the opening or Chink, making a kind of *Glottis*, which was a transverse slit, and not upright as it is in Animals that have some kind of Voice, of which our *Camelion* was wholly destitute.

The Heart was very little, not exceeding three Lines in length. Its Point appeared as if it were cut off. The *Auricles* of the Heart were very large, especially the left, and somewhat *Redder* than the Heart, which was very pale. The *Vessels* about the Heart were very full of Blood.

The Brain was found so little, that it was hardly above a Line Diameter, and was not twice as large as the *Spinal Marrow*, which was very *White*, the Brain being of a *Reddish-Gray*.

The *Optick Nerves* were not so short, that the Brain should be continued and fastened to the Eyes, as *Aristotle* describes them. They were not likewise as *Panarolus* represents them, who sayth, that they do proceed separately from the Brain, but do not joyn again; for there were two Eminences in the Brain, which were the *Origine* and first part of the *Optick Nerves*; and these Eminencies after joyning, separated into two Strings eight Lines long a piece, and inserted into the Ball of the Eye out of its *Axis*, as is usual. This Globe was covered with a *Tunica Conjunctiva*; underneath which was the Insertion of the Muscles of the Eye, which were not fibrous as *Panarolus* saith, nor of little pulleys, as *Johnson* would have it; but a true Musculous Flesh.

Over the whole *Tunica Conjunctiva*, was an Orbicular Muscle which fastened the Lidd to the Eye, to which it was so adherent, that it served to give the same Motion to the Lidd as to the Eye. Its particular Action was to close the little round hole of the Lidd; this Muscle being raised, the Iris was seen intire, which *Johnson* saith the *Camelion* wants. It was of an *Isabella* Colour, encompassed at its interior Edge with a little golden Circle, which has already been mentioned. The *Cornes* was very small, the fore-part of the *Sclerotica* very thick and hard, and the hinder part very thin. The *Choroidea* Black under the Iris, and *Bluish* in the bottom; the *Retina* very thick and somewhat *Reddish*; the *Humours* all *Aqueous*, so that it was impossible to distinguish them; the *CrySTALLINUS* is self seem'd to be confounded with the other *Humours*.

Near the place through which the *Optick Nerves* do enter into the *Orbita* or Eye-holes, several very fine fibres of Nerves did likewise enter, and passing into the Vacuity which is in the middle of the *Orbita*, did penetrate into a great

great *Sinus* which was in the upper *Jaw-Bone* where are the holes of the Noftrils. This *Sinus* was full of hard, fibrous, and very *Red* Flesh, through which the passages of the Noftrils did go; these passages being made thro' a very hard *Yellow* Membrane; they were oblique, ascending all the way from the hole of the Noftril into the *Sinus*, and afterwards they descended into the *Palate*, which by a very hard membranous production, covered the Extremity of each passage, in which we found nothing that could carry the Air towards any Organ for the Sense of Hearing.

Aristotle has observed, that the generality of Fish do hear, though they have no conveyance for the hearing; but we have found neither any passages for sound, nor any Sign in the carriage of our *Camelion*, which could make us to think that it had the Sense of Hearing: So that it is a true Saying, that it is an Animal, that neither receives nor makes any Noise.

The Nerves which proceed from the *Spinal Marrow* were easily seen when the Intrails were taken away. They proceeded after the usual manner, from the *Vertebrae*, and some of those which were distributed into the fore-leggs came out from the superiour *Vertebra* of the *Thorax*, because that the *Vertebra* of the Neck which is very short, could not sufficiently afford them. They entered into the Capacity of the *Thorax* three on each side, which first united, and being afterwards divided, returned towards the *Omoplate*. Those designed for the moving of the hind-legs, did after the same manner enter in at the sides of the *Os sacrum*, were united, and afterwards divided to distribute themselves into the Leggs. Between every Rib there was one, which proceeding from the lower part of these *Vertebrae*, at the top whereof the Rib is articulated, went cross-wise obliquely ascending towards the Ribs, and accompanied them to the end.

Aristotle says that the *Camelion* hath no Flesh but on the Jaws, and at the beginning of the Tail: Ours had all over the Body, except underneath the *Thorax* and Belly, where instead of the *Musculi intercostales*, and those of the *Abdomen*, there was only transparent Membranes, but double and fibrous, which were thought capable of assisting the Motion which the Ribs ought to have for the Respiration of the *Camelion*, which is very slow; the principal Organ of this Motion of the Ribs, being a fleshy part which descended on both sides of the Back-bone, near their Articulation, which might be the *Musculus Sacrolumbus*. All the Back-bone, Tail, upper part of the *Thorax*, the fore and hind-legs were furnished with Musculous, *Red*, fibrous Flesh, whose *White* and *Silver-colour'd* Tendons were so visible, that it would have been very easy to have made a Muscular Dissection thereof; all these Muscles being without Fatt, of which we found no appearance in all the Animal, unless one might take for Fatt, four or five little Grains like to Miller, which were fastened to the Membranes, and filled the Intervals of the Ribs: But the smallness of this Subject, which made it to dry speedily, hindered us from making our Observations so particularly as it deserves.

The last Observation which we made, but which is not the least considerable, was upon its *Tongue*, the make and use of which is very extraordinary. We found that it was composed of a *White* Flesh very solid, ten Lines long, three broad, round, and a little flattish towards the end: It was hollow and open at the end like a Sack, somewhat like the end of an *Elephants Proboscis*. This *Tongue* was fastened to the *Os Hyoides*, by the means of a sort of Trunk

like a Gut, six Inches long, and a Line broad, having a Membrane without and a Nervous Substance within. The Membrane was covered with Spots all along as if it had been imbued on the inside with a *Blackish* extravasated Blood, unequally collected in several Places. The Nervous Substance in the middle was Solid and Compact, although very Soft, and was not easily divided into Strings like the Nerves which proceed from the *Spinal Marrow*. This Trunk served to cast out the Tongue which was fastened to it, by extending it, and to draw it back by Contracting it self; and it was our Opinion that when it shortened it self, it must be, that the Membrane which covered it had a *Stylus* of a Cartilaginous Substance, very fine and smooth, inserted into it, to the end of which the Trunk was fastened, and on which its Membrane was plaited like a *Silk-Stocking* on the Leg: For we could not certainly understand how this Tongue could otherwise be retracted. This *Stylus*, which was an Inch long, took its Original from the middle of the basis of *Os Hyoides*, as it is found in the Tongue of several Birds.

The Tongue was endowed with store of apparent Vessels, by reason of the Blood which was there in great abundance, as in all the rest of the Body: Which made us wonder why *Aristotle* said that the *Camelion* has no Blood but about the Heart and Eyes; and that the generality of the Moderns do place it among those Animals that have little Blood.

It is probable that it was not the small Esteem which the Antients made of the particularities of this Tongue, which hindered them from speaking thereof; and that if they had seen to what purpose the *Camelion* uses it, they could not think that it liv'd by the Air alone: For this Tongue serves it for the catching of the Animals whereon it lives; and it is a very surprising thing to us to see the Swiftnefs wherewith it darts this Tongue at a *Fly*, and with which it draws it back again into its Mouth with the Prey, which it is said that it never fails to catch by the means of a Natural Glue which its Tongue incessantly Sweats forth, as we have observed, and which gathers together and thickens in its Cavities, which penetrates not into the Trunk to which this Tongue is fastened: So that to swallow what it has glued at the end of its Tongue, it is necessary that there be a kind of *Peristaltick* Action performed by the Tongue, whose parts successively joyned and pressed against the Palate, do there cause to run into the Throat whatever it has to Swallow. The abundance of wrinkles which we saw run a cross on the extremitie of this Tongue made us to be of Opinion that it must be so done.

Nevertheless *Marmol*, who say's that he has seen a great many live *Camelions*, with a design to explain himself upon this particular use of their Tongue, Asserts that it serves them not to catch Insects, and that whatever he has observed of this Animal could not make him to alter his Opinion, that its only Nourishment is the Air and the Beams of the Sun.

Yet we have found its *Ventricle* and *Intestines* filled with *Flies* and *Wormes*, having seen it swallow them after the manner aforesaid. We have likewise observed that the Excrements that it voided almost every day were mixed with store of *Yellow* and *Greenish* Choler, and such as they are in Animals which do live in something else besides Air: Which *Nidermayer*, Physician to the *Landgrave* of *Hessen*, who in the Year 1619. brought a live *Camelion* from *Malta* into *Germany*, hath already observed. Our's did many times void Stones about the bigness of a *Pea*; which it had not swallowed, but
which

which were ingendred in its *Intestines*, as we discovered after a Curious Examination: For it was found that these Stones were so light, that being put into distilled Vinegar, they rose from the bottom of the Vessel when stirred; that they did there Dissolve, and that one of them which cleft contained in its middle the head of a *Fly*, about which the Stony matter was amass'd.

This made us to think that the *Lienteria* which *Panarolus* Reports, to be perpetual in the *Camelion*, was not the Distemper of our's, seeing that retaining the Useful things, it rejected those only which were Superfluous, and not fit to be kept.

It is true indeed that it voided *Flyes*, which appeared almost as intire as it had taken them; but it is known that this happens to *Serpents*, which do *Evacuate* Animals whole as they have swallowed them: And every body know's that the manner of drawing the *Nutritive* Juice from the Food, is different in different Creatures; that some must Dissolve what they Eat; and therefore they do first Chew it, and afterwards reduce it into Liquor in their Stomach; that others, who Swallow without Chewing, have a Heat and Spirits powerful enough to Extract the Juice they have need of, without breaking that which contains it, even as it is seen that the Juice of the *Grapes* is drawn as well from the *Rape*, where the Stones remaine whole, as from a *Vat* wherein they are bruised.

By these Observations we thought there was not less reason to doubt of the Truth of the Proposition, which the Ancients had started touching the Aerial Nourishment of the *Camelion*, than we have had to reject that which they had establish'd touching the changeing of Colour which they have said happens to it by the touching of the different things which it approaches, after having observed, that except the *White* which our *Camelion* took in a Linnen Cloath, all the other Colours, wherewith it was covered, proceeded not from the things which it touched. And it is rational to think, that the *White* which it received in a cold Linnen Cloath where it was kept some time as under a Cloak, was an effect of the Cold which generally made it grow *Pale*, because that very day was the coldest of all those whereon we observed it.

And to the end that *Naturalists* and those which Study Morality may not be troubled for Curious Subjects to exercise their Philosophy, which they thought to have found in the extraordinary particulars, which the Ancients had left in Writing concerning the Wonders of the *Camelions* Nourishment and change of Colour, we do think that the new Observations of the Motion of its Eyes, and that of its Tongue, and the manner of changeing Colour according to its Passions, are altogether as capable of employing their Wits.

For to demonstrate that Flatterers want Sincerity, and that Vain and Ambitious Spirits feed on *Chimara's*; it is not necessary to be true that the *Camelion* takes all Colours but *White*, and that it lives only on Air: And one may find as much ground, but with more truth, to Moralize on this, that the *Camelion*, which is without Ears, and almost without Motion in most of its parts, hath Nimbleness only in the Tongue, which lets nothing escape it, and in the Eyes which can see all ways at once.

Naturalists will likewise have a great deal to do, before that they have clearly demonstrated from whence proceeds the necessity which Nature has imposed on all other Animals of Moveing both Eyes together after one manner. For the *Camelion* shews that it is not the joyning of the Optick Nerves, which causes this necessity, as many were of Opinion. They will also have trouble enough to tell what Power do's so far push out, and almost at the same instant draw back this Tongue, and even to produce instances like it. For the moveing of the Muscles, which is attributed to the different position of their Fibres which makes them contract and extend, is nothing proportionable to the quickness of the Motion of this Tongue, nor to the greatness of the space which it runs through. For when our hand is carried swiftly for the space of seven Inches, which is what we have observed the *Camelions* Tongue to move, the contracting of the Muscles which gives this Motion to the hand, do's never exceed the length of two lines, that is to say the fortieth part of the contraction of this Tongue. And though, there be some colour to say that it is thrust out, and if I may so say, Spirt out by the Effort of the Wind wherewith the Lungs are swelled, and that it is drawn back by the Nerve which is in the middle of the Trunck, which having been stretcht out by this Effort, makes it to return back to its first state, and suddainly draws in the Tongue. There is yet this difficulty, that this cannot be performed without a great deal of Noise and we have observed that this darting out of the Tongue causeth not the least.

It is likewise a very difficult thing to imagine, what becomes of this Nervous Substance which fills the middle of the Trunck to which its Tongue is fastened, and where it can dispose it selfe when it is drawn into the Mouth. For when it is there, the Root of the Tongue do's almost touch the extremity of the Cartilaginous *Stylus*, on which supposing the Membrane of the Trunck to be folded and drawn on, as has been said, that Nerve cannot be drawn on after the same manner, by reason that it is too Solid and compact; and this Solidity hinders us also from thinking that it shrinks, and as it were enters into it self to retire from the six Inches in length, which it has when extended, to that of a Line, to which it is reduced being contracted.

It cannot be said that it bends like the Neck of a *Tortoise*, when it draws its Head into its Shell, because that this bending is performed by the assistance of Divers Muscles, which do bend this Neck composed of several *Vertebrae*, and that such Organs are not found in the *Camelion's* Tongue. The Tongue which the *Wood-pecker* shoots out a great way beyond its Beak, has Organs also, whose Substance is much fitter for this Action, than that of the Trunk of the *Camelion*; for there are very long Muscles, bending over the Head, which consisting of fleshy Parts, have an aptitude to extend and contract themselves, which in their great length may produce a considerable extension and contraction. So that we may say, that this so strange a Motion of the *Camelions* Tongue, do's somewhat resemble that of the Horns of a Snail, and that so great a length as this is reduced almost to nothing in this Trunck, by the increate of its thickness, and by a great dilatation, caused by the powerful and suddain rarefaction of the Black and thick Blood, which appears unequally disperfed through the whole length of the Trunck. Yet that do's not sufficiently explain the thing, because that if the rarefaction

causeth

causeth the dilatation which makes the contraction; it cannot afterwards produce the extension in the same Organe; and it is to be supposed that the extension proceeds from the rarefaction which is made in one of the two parts of which this Trunck is composed, *viz.* in the Nerve which is in the middle, and that the contraction happens when the Rarefaction is made in the other part *viz.* In the Membrane which is without it, by means of a different Situation of the *Fibres* in the one and other of these Parts: So as it is probable that the extending and contracting of the Tongue of other Animals is performed. But the bigness and Fleshy Substance of other Tongues are Dispositions to perform these Actions, which are wholly wanting in that of a *Camelion*, although this effects them with incomparably more Force; which makes that Motion Marvelous, and difficult to Comprehend.

But above all the change of Colour will a long time detain the Curious before they will Discover the Cause, and be able to Determine whether it is done by Reflexion, as *Solinus* thinks; or by Suffusion, as *Seneca* is of Opinion; or by the change of the Dispositions of the Particles which do compose its Skin, according to the Doctrine of the *Cartesians*. Yet it is True that the Suffusion is most easie to comprehend, especially to those who shall have observed that the Skin of the *Camelion* has a Natural Colour, which is a *Blewish Gray*, which was seen on the inside when it was flea'd; that there was easily taken away a great number of little Pellicles from above each of the Eminencies, which are the only Parts of the Skin which do change Colour; and that these thin Skins are separated, or easily separable one from another, whereas those which do compose the rest of the Skin, are exactly fastened together. For these things having been observed, there will be found some probability to think that Choler wherewith this Animal abounds, being conveyed to the Skin by the Motion of the Passions, may creep between these Skins, and that according as the Choler enters under a Pellicle nearer, or more remote from the exterior Superficies of the Eminencies, it Dy's them *Yellow* or *Green*: For it is seen by experience that *Yellow* mixt with a *Blewish Gray* makes a kind of *Green*; so that it is easie to Imagine that the same Choler spread under a very thin Pellicle may make it appear *Yellow*, and that being under a thicker Skin it mingles its *Yellow* with the *Blewish-gray* of this Skin, to produce a *Greenish-gray*, which with the *Yellow* are the two Colours that the *Camelion* takes when it is in the Sun, where it Delights its self: For when it is moved by things which disturb it, it is not strange that the *Black*, and adust Humour which is in the Blood, being carried to the Skin, should there produce the *Brown* Spots which appear on it when is Angry; even as we do see that our Countenance becomes *Red*, *Yellow*, or *Livid*, according as the Humours, which are Naturally of those different Colours, are carried thither. By the very same reason also, when by a contrary Motion the Humours, wherewith the Skin is Naturally imbued, do return into the Vessels, or dissipate themselves, so that others do not succeed in their place, the Skin waxeth *White* by the separation of the Pellicles, which do compose the little Eminencies; for this *Whiteness* happens to them as to our *Epidermis* or *Scurf-skin*, which being dried, and separated into little Flakes in the Disease called *Pityriasis*, the Skin *Whitens* extraordinarily, and seems to be rub'd over with Meal. Abundance of such probable reasons may be found,

found, before any one shall occur, whereby the Truth may be demonstrated.

But to conclude our Observations on the *Camelion* with something more Solid than is in this Philosophy of Colours, we will relate the Remarks which we made on its Bones, whereof we do keep the *Skeleton*, and wherein we have observed a great many considerable particulars.

The Bones which composed the *Cranium* or Skull seem'd to be made only to sustain the *Crotaphita* which filled all the Head, as well without as within with a Whiteish and Fibrous Flesh. The three *Crests* which were upon the Head mett together in one point towards the Back part. Two of these Crests which covered the Eyes like Eye-brows left great vacuities, each making a kind of *Zygoma*. The principal cavity of the Skull consisted in the *Orbita* or Eyeholes; for that wherein the Brain is contained was without comparison the least. These two *Orbita* were open one into the other, so that the Eyes touched on the inside, as is seen in several Birds: Which *Pliny* has excellently described, when he says that the *Camelions* Eyes are very large, and little distant one from the other. For this little separation cannot be meant of that which is at the Face between each Eye, because that is very broad in all *Camelions*; this little distance of the Eye one from the other in the Face being proper to Man only, as the greatest is peculiar to Sheep, according to *Aristotles* opinion.

Each half of the lower Jaw was composed of two Bones articulated *per Diarthrosin*, the *Apophysis* which goes from the corner of the Jaw to the *Condylus* which is articulated with the Bone of the Temples being a distinct Bone.

The Back-bone, comprehending the Tail, had seventy four *Vertebra*, two in the Neck, eighteen in the Thorax, two in the Loynes, two at the *Oss Sacrum*, and fifty in the Tail.

The first of the Neck was the only one which had its Spinous *Apophysis* bent upwards, and which was differently from the rest received on both sides. All the other had in their Body a Cavity in their upper part which received, and in the lower a Head which was received by the Cavity of the next, which made a kind of *Ginglymos*. All in general had their seven *Apophyses*, except the *Vertebra* of the Tail, which have eight, *viz.* two Spinous, a large one, and another very small one underneath. with the two transverse and four Oblique ones, by the means of which all the *Vertebra* were articulated, the oblique Superiour *Apophyses* of one *Vertebra* passing over the lower of the *Vertebra* next above it.

The Ribbs which *Gesner* makes sixteen were eighteen of each side, and of three sorts. The two first above reacht not to the *Sternum*, no more than the three last below. The third, fourth, fifth, and sixth, were joyned there by *Appendices*, which were not *Cartilaginous*, but of the same Substance with the Ribbs; and these two sorts of Ribbs were joyned together by an Angle which they made, the one descending downwards, and the other ascending towards the *Sternum*. The other nine Ribbs were not fastened to the *Sternum*; but each was joyned to its opposite, by the means of a common Appendix, and which went from the right Ribb to the left, being bent in the middle of the Breast and Belly.

The

The *Sternum* was composed of four Bones, the first of which was very large, and made like a *Trefyle*. The *Omo-plata* or Shoulder-blades were so long, that they reached from the Back-bone to the *Sternum*, to which they were joyned instead of *Claviculae*. The *Ossa innominata* were after the usual manner joyned by the *Os Pubis*; but the *Ischium* was not firmly articulated to the *Sacrum* by a *Cartilage*: For it was the *Os Ilium* which was there fastened by a loose Ligament, so that it appeared that these Bones, after the same manner as the *Omo-platae*, have a Structure and connexion altogether different from what is found in all other Animals, where the *Omo-platae* are fastened to the Trunk of the Body, but by very loose Ligaments, in comparison of the *Ossa innominata*: And it has been observed that the *Omo-platae* in the *Camelion* are very closely fastened to the Trunk, as has been said; and the *Ossa innominata* on the contrary are very moveable, even as the *Omo-platae* are in other Animals.

The *Ossa innominata* made a hole forwards on each side, but which was partly formed by the *Os Pubis*, and partly by the *Ischium*.

The *Humerus* which was articulated with the *Omo-plata per Ginglymus*, as the *Femur* is generally with the *Tibia*, had an *Apophysis* near its Head like to a *Trochanter*; and the *Femur*, which was joyned with the *Ischium per Enarthrosis* had no *Trochanter's*.

The Leggs as well before as behind were alike, being every one composed of two Bones, which rather resembled a *Radius* and *Cubitus*, than a *Perna* and *Tibia*, because that they were both articulated to the *Femur* as well as the *Humerus*, and were both capable of bending upwards and downwards.

The Feet and Hands, or rather the four Hands, were also alike, and differed only in this, that the Fore-feet had as it were a *Carpus* composed of twelve little Bones, and those behind had something which rather resembled a *Tarsus*, because that the Bones were larger than those which seemed to make the *Carpus*. Yet there was none which jetted out enough behind to make a *Talus*; which might be one of the Causes which makes the *Camelion's* Pace so slow. These Bones of the *Tarsus* were six in Number. There was neither *Metacarpus*, nor *Metatarsus*; unless you would so call the two first *Phalanges* of the Toes, because that they were joyned together as the Bones of the *Metacarpus*, and *Metatarsus* commonly are, there being only the last *Phalanges* which were separated, and appeared like Toes. There was likewise this difference between the Feet and Hands; for in the Feet the Part which hath three Toes was articulated on the right side of the greatest of the two Bones which do make the Leg; and on the contrary in the Hands, it was set against the least of those whereof the Arm is composed.

After having made these Remarks, we found that the *Skeleton* and *Skin*, which was layd up, retain'd for some time a strong Scent, inclining much to that of *Fish* beginning to stink; and that this ill Smell, as these parts grew dryer, was changed into a Sweet and agreeable Smell, very like that of the Roots of the *Iris* and *Violet Flowers*; and that at last all the Odour evaporated, when the rest of the *Humiditie* was consumed.

As for the knowledge of the incredible Virtues which the Superstition of the ancients hath attributed to the *Camelion* and of which *Pliny* saith that *Democritus* hath writt a whole Book, they are so Extravagant in the Judg-

ment even of *Pliny*, that we refer our selves to his opinion thereof: And without trying whether we could raise Tempests with its Head, or gaine Law-suits with its Tongue, or stop Rivers with its Tail, and do the other Miracles which it is said *Demaritis* hath left in Writing; we were contented to make those Experiments which seemed to have some probability, being founded on Sympathie and Antipathy, such as is that which *Solomon* Reports to be so great between the Crow and the Camelion, that it dyes immediately after having Eaten of its Flesh. The truth is that a Crow peckt several times with its Bill on our Camelion, when it was set to it Dead; and we gave it several Parts of it so Eaten, and even the Heart is self, which it swallowed without any harm.



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The

The Explication of the Figure of the DROMEDARY.

IT is represented in the lower Figure, so that there may be seen the height of the Bunch which it has upon the Back, and which is for the most part composed of long Hair, which stands upright. There is also seen the four Kinds of *Callosities*, which are at the Parts on which it rests it self when it lyes down, *viz.* The two *Callosities* of the Fore-leggs, that of the Thigh, and that of the Breast. Its Feet are likewise so raised that they do present a part of the Sole to the Eye.

In the Upper Figure.

- A. *The first and greatest of the four Ventricles.*
- Γ. *The Oesophagus.*
- B. *The second Ventricle.*
- C. *The Third.*
- D. *The Fourth.*
- E. *The Pylorus.*
- FFF. *The second Ventricle cut in four.*
- G. *The hole which is the passage of the first and great Ventricle into the second.*
- h h h h. *The holes of the Sacks, which are between the Coats of the second Ventricle.*
- I. *The Glandula Pinealis.*
- K. *The Sole of the Foot, which is Solid, and covered with a very soft and delicate Skin.*
- L. *The upper Part of the Foot, which is a little Cloven.*
- M, *The Penis.*
- NO. *The Tongue.*
- OP. *The Part which is rough from the inside to the end, by reason of an abundance of little pointed Eminencies.*
- Nq. *That which has the greatest Eminencies turned after the same manner as the little ones.*
- qp. *That which has likewise great Eminencies, but which are turned opposite to the little ones.*
- q. *The Center of the great Eminencies.*

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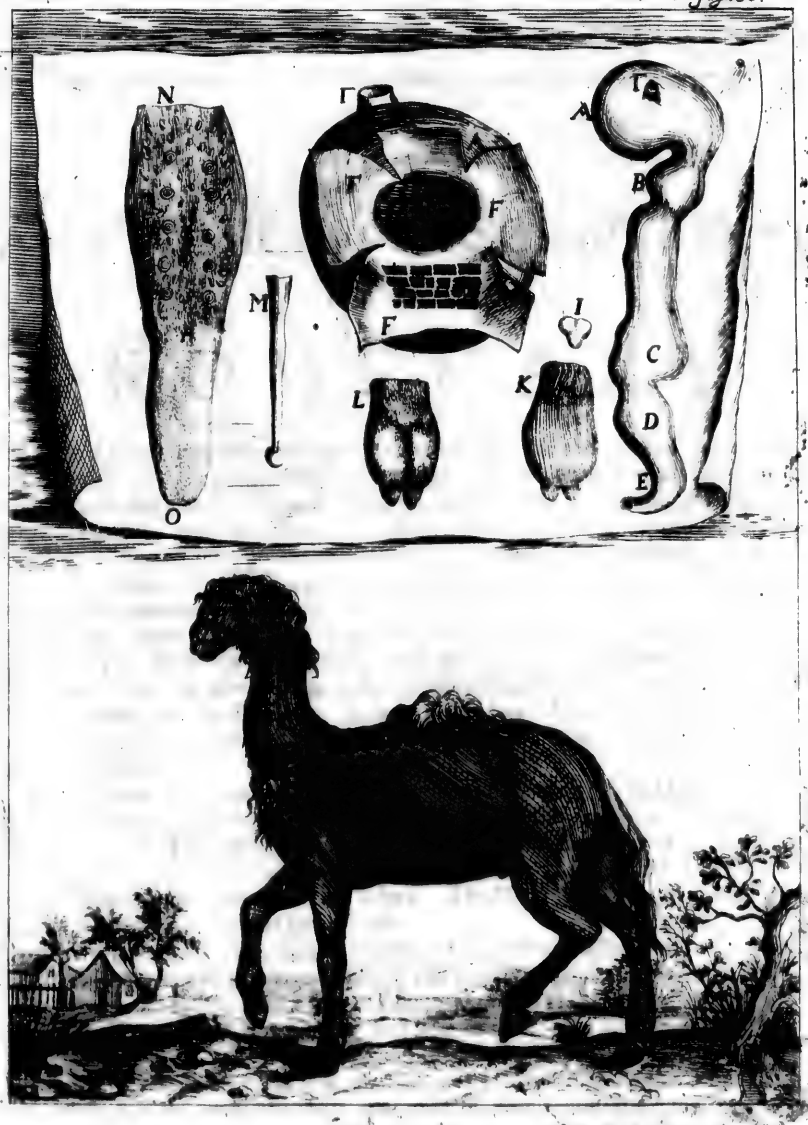
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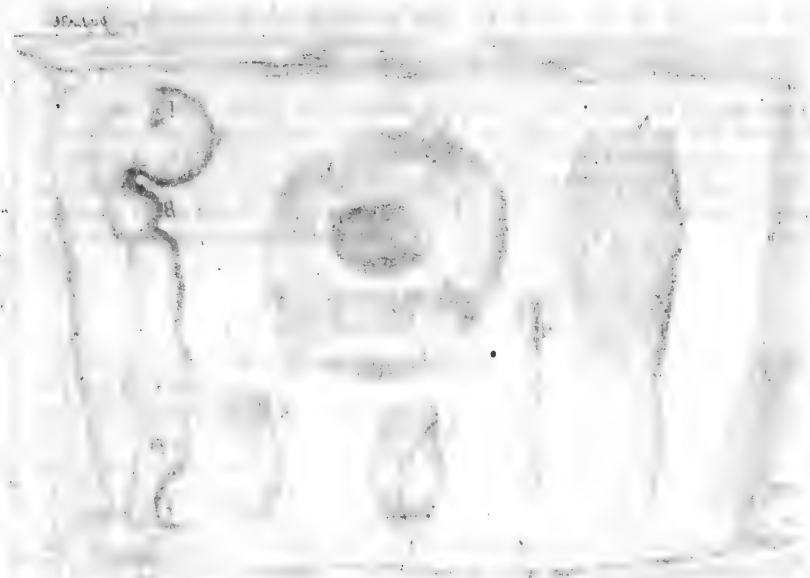
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THE
ANATOMICAL DESCRIPTION
OF A
DROMEDARY.

THis Animal here described we call a *Dromedary*, altho' the common practice be to give the name of *Camel* simply to that which like it has but one Bunch on the Back, and of *Dromedary* to that which hath two according to *Solimus*, but contrary to what *Aristotle* and *Pliny*, and the generality of Authors have Writt thereof, who do make two sorts of *Camels*: whereof one, which retains the Name of the *Genus*, has two Bunches, and is most commonly found in the Eastern parts of *Asia*, and is therefore called *Bactrianus*; it is also bigger and more proper to carry heavy Burdens: The other, which is Lesser, and fitter for the Course, and which for this reason is called *Dromedary*, has but one Bunch, and is most commonly seen in the Western Parts of *Asia*, viz. in *Syria* and *Arabia*. The *Sieur Dippi* an *Arabian*, who was present at our Dissection, informed us that the *Camels* of his country are like to Ours.

It was seven Foot and a half high from the Crown of the Head to the Feet; five and a half from the highest bending of the Back-bone, which is the Bunch; Six Foot and a half from the Stomach to the Tail, of which all the Knots or *Vertebrae* were fourteen Inches together; and all the Tail comprehending the hair, two Foot and a half. The Head was One and Twenty Inches from the hinder-part to the Nose.

The Hair was of a *Fawn-Colour* inclining a little to an *Asb-Colour*. It was very soft to the touch, moderately Short, and somewhat shorter than an *Oxe's*, excepting some places, where it was longer, as on the Head, under the throat and on the fore-part of the Neck. But the longest was on the middle of the Back, where it was near a foot. In this place, although it was very soft and limber, it stood erect, so that it made the greatest part of the Bunch of the Back, which when this hair was pressed down with the hand, hardly appeared more Elevated than a *Doggs* or *Swines*, which are Animals that have not the Back Sunk, as *Horses*, *Cows* and *Staggs* generally have. And indeed there are some Authors which do say, that the *Dromedary* is engendered of the *Camel* and *Hogg*. This is very repugnant to *Aristotle*, who asserts, that

that there is no Animal which hath the Back bunched like the *Camel*. Some Authors do say, that this Bunch is a Flesh peculiar to this Animal, which rises upon the Back over the *Vertebrae*, and which waists away, when after a long abstinence from Food, it grows extraordinary lean. But we found not any appearance of this Flesh in our Subject, although it was not lean; and without this Flesh, the Bunch which was made only by the Hair, was much raised, as is seen in the Figure.

Besides these two sorts of Hair, *viz.* The long which was upon the Back, Head, and Neck, and the short which covered the rest of the Body; there was likewise a third sort at the Tail, which differed from the others, as well in bigness as Colour, being Gray and very strong, and altogether like the Hair of a *Horse's* Tail.

The Head was little in Proportion to the Body; the Nose was cleft like a *Hare's*, and the Teeth like to those of other Animals which do chew the Cud, having no *Dentes Canini* nor *Incisores* in the upper Jaw; although the Head wants the Horns which Nature has given and bestowed on the greatest of those which do chew the Cud. *Cardan* says that it has recompensed this defect of the *Camel*, by arming its Feet, which have Hoofs like those of *Oxen*, according to *Pliny*: But that is not found, for it has neither Horn nor Hoof on the Feet which can render them dangerous, each Foot being furnished only with two little Nails at the end; and the Sole which is flat and broad, being very fleshy, and covered only with a soft, thick, and somewhat callous Skin, but very fitt and proper to travel in sandy Places, such as are in *Asia* and *Africa*. We thought that this Skin was like a living Sole, which wore not with the swiftness nor continuance of the March, for which this Animal is almost indefatigable: For when *Aristotle* says, that they are sometimes forc't to defend, as it were, with Boots the Feet of those which are in the Armies; it seems to be not so much to ease them from the inconveniencies which they do undergo in travelling, as to prevent and keep off the Wounds which they might receive in the Warr. And it may be said that this softness of Foot, which yeilds and fits it self to the ruggedness and unevenness of the Roads, do's render the Feet less capable of being worn, than if they were more solid; although *Pliny* thinks that it is not possible, that *Camels* can make long Journies if they are not shod: Its callous Kn's are much harder, and do nearer approach the Solidity of the horny Hoof of other Animals.

Aristotle hath remarkt other Particulars in the Foot of the *Camel*, which we have not found there. He says that it is cleft in two behind, and in four before, and that the interstices are joyned by a Skin like the Feet of a *Goose*, which was not found in ours, whose Foot was only cleft at top, within four or five Fingers of the end; and this slit was not joyned by a Skin, but underneath this slit which is shallow and not very deep, the Foot was solid.

The *Callosities* of the Knees were six in Number, *viz.* one at each of the Joynts of the fore-leggs, the first and highest being behind, at the Part which is properly the *Cubitus*; and the second and lower of the two before, upon the Joynt of the Knee which represents the Wrist: Each hind-legg had likewise one on the first and highest Joynt, which is that before, and which is the true Knee.

Aristotle.

Aristotle, who has observed but four of these *Callosities*, which he calls *Knees*, and who groundlessly reproves an ancient Author, which is *Herodotus*, for having made six, adds also a thing more strange, which is to say, that the *Camel* never bends its Legs but in these four places: For the Truth is, that it bends them in Eight, like other Quadrupeds, and that there are only the two bendings which do supply the place of the Heel in the hind-legs, which have no *Callosities*.

Having opened these *Callosities*, to observe their Substance (which is between Flesh, Fat, and Ligament) we found that in some there was a heap of thick Pus, which made us to think as some Authors do report, that *Camels* are subject to the Gout; and we conceived that it might be, that our *Dromedary* had been tainted with this distemper, which was ended by a Suppuration.

Besides these six *Callosities*, there was a seventh much bigger than the rest, at the bottom of the Breast, firmly joyned to the *Sternum*, which had an Eminence in this Place. It was eight Inches long, six broad, and two thick. It was likewise very much suppurated, and it was judged that this Part was as susceptible of the Gout as the Articles or Joynts, because that its use being to support the whole Body alone whilst it was loading, couched upon the Ground, that hardship might make this Part capable of the weakness and heat which do attract the humors on the Joynts, and which do hinder that they cannot digest and dispose them. The great Sobriety which is remarkable in the *Camel*, and the incredible Fatigue which it generally suffers, do demonstrate that the greatest hardships may produce the Gout, as well as Idleness and Debauchery.

Before we opened it to observe the inward Parts, we took notice that the *Præputium*, which is very large and loose, covered not only the end of the *Penis*, but that it turned backwards; which may have given occasion to the Opinion of those, who have thought that the *Camel* pulled backward, like the *Lion*, *Castor*, *Hare*, &c. whose *Penis* bends not forward.

The internal Parts are very like to those of the *Horse*. The Liver had three Lobes, two very large ones, in the middle and underneath which there was one which was lesser and pointed. The Ligament which held the Liver suspended was not fastened to the *Cartilago Xiphoides*, but to the center of the *Diaphragme* on which the Membrane of the *Peritonæum* which covered it, had a lustre, which made it appear as it were all over gilded. The Gall was not contained in a *Cystis*, but spread over the Liver, in its *Ductus Cholidochus*.

The *Ventricle* which was very large, and divided in four, as in the other Animals which chew the Cud, had not that different Structure, which is observed within the four Ventracles called by *Aristotle*, *Κολία*, *Εγύθη*, *Κενύραλλο*, *Ηνωτορ*. They were only distinguished by some straitenings, which made that the first Ventricle, which is large and vast, produced another very small one, which was followed with a third, somewhat less than the first, but much longer; and this was followed by a fourth like to the second.

At the top of the second Ventricle there were several square holes, which were the Orifices of about twenty Cavities, made like Sacks placed between the

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Aristotle,

the two Membranes which do compose the Substance of this *Ventricle*. The view of these Sacks made us to think that they might well be the Reservatory's where *Pliny* says that *Camels* do a long time keep the Water, which they do drink in great Abundance when they do meet with it to supply the wants which they may have thereof in the dry Desarts where they are used to travel, and where it is said that those which do guide them are sometimes forced by extremity of Thirst, to open their Belly, in which they do find Water. There is likewise some reason to say, that the instinct which *Aristotle* and *Pliny* have observed to have been by Nature bestowed on this Animal, of always troubling and muddying with its Feet the Water which it would drink, might rather be to render it heavy, and consequently less fit to pass speedily, and more capable of being a long time retained in its Stomach.

The Intestines were of four sorts. The first at the entrance of the fourth Ventricle were of a middle-size; they were six Foot long. The second were, as it were ruffled and contracted by several folds, as the *Colon* usually is by means of a Ligament which tacks it together, and makes it as it were divided into several cells. These were also of a middle-size, and were twenty Foot long: The last which were the smallest were Fifty six Foot long; the whole making eleven *Toises*; and there would have been found above thirteen, if those had been unfolded which were ruffled and contracted.

The Spleen was layd upon the left Kidney. It was Nine Inches long, four broad, and half an Inch thick.

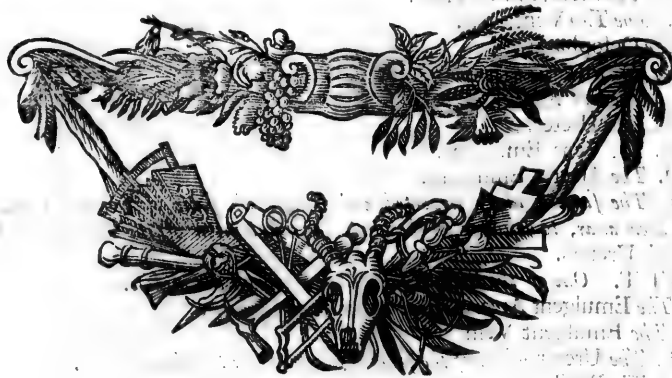
The *Penis*, of which it is said, that Bow-strings are made, was Nineteen Inches long. It was very pointed at the end, which was bent, and made as it were a Hook of a cartilaginous Substance, without any appearance of the *Balanus*. The Extremity of the *Preter* was a very small Membrane.

The Lungs had but one Lobe on each side. The Heart was of an extraordinary bigness, being Nine Inches in length, and seven in breadth: It was very pointed.

The Structure of the Tongue was remarkable, in that contrary to all Tongues which are all over asperated inward, by the means of abundance of little Eminencies which do tend inwards; one part of this Tongue had them from the in-side to the out-side; for the half towards the end which was very small, was rough as usually from the in-side to the out-side; but the other half near the Root which was very thick, had towards the middle a little Circle, like a Center amongst several Eminences, which covered all this second half of the Tongue, and whose Points were all turned from this Center, making a roughness when we rubed them towards this Center. Amongst these Eminencies there were others placed in two Rows, in a direct Line, five in each Row, which were Navils, formed by wrinkles folded round after a very delicate and curious Structure. The Figure explains this more clearly than the Discourse.

The whole Brain comprehending the *Cerebellum*, was but six Inches and a half long, and four broad. The *Optick Nerve* was pierced, according to its length, with a number of holes full of Blood. The *Processus Mamillares* were very

very large and hollow, having each two *Ductus's* or passages, the one of which appeared round, and the other like a Crescent, by a transverse Section. The *Glandula Pinealis* was about the bigness of a small Filbert, and as it were composed of three other Glands, which left a dent in the middle.



The Explication of the Figure of the B E A R.

IN the lower Figure the *Bear* is represented two ways, *viz.* with its Skin on the one side and without it on the other ; the more plainly to discover the Forme and Shape of its body, which is principally remarkable in its Hind-leggs.

In the Upper Figure.

- A B C. *The left fore-paw.*
 B. *A little Toe which is in the place of the Pollux.*
 A. *A Great Toe in the place of a little one.*
 f. *A Callosite on the Carpus, which as it were makes a Heel.*
 D E G. *The left hind-paw.*
 E. *A little Toe which is in the place of a bigger.*
 D. *A great Toe in the place of a lesser.*
 G. *The Heel covered with Hair.*
 H I. *The Two Ventricles.*
 H. *The Oesophagus.*
 I. *The Pylorus.*
 K L. *The left Kidney.*
 M M. *The Ureter.*
 N N. *The Vena Emulgens.*
 O O. *The Arteria Emulgens.*
 P Q. *The same Kidney inverted, and from which some of the little Kidneys are Taken away, to discover on the inside the distribution of the Emulgent Vessels and Ureters.*
 R S T T. *One of the little Kidneys cut through the middle.*
 R. *The Emulgent Arterie of one of the small Kidneys.*
 S. *The Emulgent Vein.*
 T T. *The Ureter of one of the small Kidneys cut in two length-wise.*
 V V. *The Papillæ.*
 Y Y Y Y. *The halves of the Pelves.*
 X X. *The little Sinues which are between the Pelves and Papillæ.*

Kidneys are ent Vessels



T H E



T H E
ANATOMICAL DESCRIPTION
O F A
B E A R.

THe bigness and thicknes of the Hair, in which the whole Body of the *Bear* is hid after such a manner, that it seems to be but one lump, which hardly has any appearance of an Animal, has made it to be rightly called by *Virgil Informe*; but there is no one which do's not find it wholly *Difforme*, when the Skin being slead off, it's true shape and Figure may be seen, without any hindrance or obstruction. This deformity, just as that of the *Ape*, which is accounted the ugliest of all Creatures, is founded on the ill resemblance which they both have, with the handsomest of all Animals, by the general and ever true Rule, that the depravation of things the most perfect is the worst.

That which makes the Body of Man admirable, according to *Galen's* Opinion, is the structure of the Hands and Feet, which distinguishes his Body from that of other Animals, even as Reason makes the difference of Souls. This Structure is altogether extravagant in the *Bear*, in that having something which in appearance, approaches that which makes the perfection of these Organs; it is found that in Truth, that which is most important in their conformation is depraved, or wholly defective in the *Bear*. *Galen* Remarks two things, which are principally necessary for the conveniency of the use of these Parts, *viz.* In the Hand, that its five Fingers be generally divided into two Parts, having four of them joyned together, which are as it were of one sort, and a fifth Part which is so separated, to serve the principal Action of the Hand which is to take hold; and in the Foot, that it is composed of the Heel of one side, and of the five Toes which oppose it on the other, as the four Fingers of the Hand are opposite to the Thumb; to make the Step more sure and firm, by the different application of these two Parts, to the Figure of the things on which we tread.

Pliny, who has spoken of the resemblance which the Paws and Feet of the *Bear* have with those Parts of Man, has not well understood it, making it to consist in the Position of the Elbows and Knees, which he Reports to be in the *Ape* and *Bear* as in Man, and contrary to other Animals, who have

the Knees behind and Elbows before: For the Truth is, that all Animals have these Parts turned after the same manner, whatever *Aristotle* may report thereof; and that what is there found different, proceeds from hence, that the Heels in Brutes are taken for the Knees, the *Carpus* or the *Cubitus*: Because that the Bone which makes the Heel of Man, is so lengthened in Brutes, that it is taken for the Legg, and that the Wrist, which in Man is composed of a connexion of eight small Bones, almost round, which is called *Carpus*, has in the generality of Brutes one of these Bones very long, and which is taken for the fore-legg, though it be properly one of the bones of the *Carpus*. So that the Leggs and Paws of the *Bear* are in this only as in Man, that they are fleshy, although *Aristotle* says that there is none but Man which has them so: That the *Osculeis* or Heel-bone is short, and makes a part of the Sole of the Foot: That there are five joyned together, and opposed to the Heel, and that its Paw has likewise the Bones of the *Carpus* almost even, and united like ours; but in its Paw it has no Thumb separate from the four other Fingers, and the biggest of the five which do compose the Paw, and which has only that bigness which may make it to pass for a Thumb, is placed quite contrary to Mans, being on the outside, and in the place of the little Finger, even as on the Foot where the greatest Toe is also on the outside. As to the Foot it is not usually rested on the Heel, which by reason hereof is covered with Hair like the Legg, and has no *Callosities*, nor that kind of particular Skin which defends the Sole of the Foot, and which leaves its Print on the places where it has gone. On the contrary, its Paw has as it were a Heel, that *Callosity* which is in the palm of the Paw, being interrupted by the hairy Skin, to begin another *Callosity* a little higher. In a word, the Fingers of the Paw are likewise very ill shapen; and unfit for their uses, being great, short, and fastened to each other as in the Feet.

The Substance of these Parts is not less particular, nor less remarkable than their Structure. *Pliny* and *Plutarch* do report that it is an excellent Food; and *Michael Herms* says that in *Germany* they are even at present reserved for Princes Tables, at which the Paws of the *Bear* are served up salted and smoked. We observed that this Substance good to eat, was a fat Ligament, very white and delicate, about two Fingers thick, which was on the in-side of the Paws and Feet; and it is questionable, whether it be not probable that there may proceed some moisture from this Part, which has occasioned *Ælian* and *Pliny* to say, that the *Bear* Lives Forty Days by licking only its right Foot.

The Claws of the two *Bears* which we dissected, were fastened to the last *Phalanx* of the Toes after the same manner as in the *Lyon*, having by the particular Structure of this Article or Joynt, which we have described in the *Lyon*, the Faculty of holding its Claws elevated in its March to preserve the Points thereof; but it appeared that our *Bears* had neglected to use this Faculty, because that their Claws were half worn away. They were Black, and much lesser than in the *Lyon*, as might be judged by what remained. The manner how these Claws were worn, demonstrated that their Substance was very different from that of the *Lyon*; for in the *Lyons* which we dissected, the Claws were also somewhat worn on one Paw, but as fibrous Wood would wear; whereas those of the *Bear* were like Iron: That is to say, that the Claws of the *Lyon* are composed of separable fibres, by reason that they

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are of an *Heterogeneous* Substance, and that the Claws of the *Bear* are of a more even and more compact Substance.

The Teeth were like to those of the *Lyon*, save that they were much less. Therefore it is said that it uses only its Paws to break the 'Netts and rend the Snares of the Hunters, because that the bigness and thickness of its Lipps hinders it from using its Teeth. These Lipps have also a very extraordinary shape, the lower ones being wrinkled, and cut from the two corners like a *Cock's-Combe*.

The length of the whole Body, from the end of the Muzzle to the end of the Toes, was eight foot three inches; Five Foot and a half to the beginning of the Tail, which was Five inches; and one foot five Inches to the hinder part of the Head, which was flat and made an angle with the bones of the fore-part Direct from the *Sutura Lamdoides*, at the middle of which abutted a *Crest* elevated like that of an Helmet, but much less than on the *Lyon*; and from whence the *Crotaphita*, which did Likewise Cover the head, did also take their original, being a great deal less fleshy.

The *Thorax* was larger than in the *Lyon*, and also very long, being composed of fourteen Ribbs. The Neck was not Short in proportion to its breadth like a *Hogg*, as Authors do report: for it had seven inches in breadth, and Nine in length: the great thickness of the hair which furrounds and enlarges this Neck, is that which makes it to appear short.

The *Os Femoris* or Thigh-Bone was proportionably longer than it generally is in Brutes, and it was articulated with that of the Legg by means of a *Rotula*, which some Authors do say is found only in Man.

The Skin which was very hard and very thick on the Back, was found very thin and Delicate under the belly. The Hair was not so harsh and stubborn as in the *Lyon* and *Wild-Boar*, in some sort resembling Wool. more Frizled than the *Goats*, and much less than the *Sheeps*.

As for the internal parts of the Body, the *Epiploon* was very large but very lean, like all the rest of the body, which neither on the inside nor the outside had one scrap of fat: which might be an effect of the distemper whereof it died, the natural constitution of the Animal being to be very fat, and the *Winter* being the Season in which it grows fattest.

The *Liver* was vastly great, and divided into seven *Lobes*, one of which was much less than the rest. The *Cystis fellea* was not half so big as in the *Lyon*: yet there was much gall diffused on the membranes of the circumjacent parts.

The *Oesophagus* which exceeded not fourteen lines in diameter, and enlarged not it self towards the superiour orifice of the Ventricle, was outwardly very fleshy to the Ventricle, which was extremely small, although *Aristotle* affirms that the *Bear* has it very large as well as the *hogg*. Which he says (perhaps) with all other Authors, because that they have thought that the *Bear* being a great feeder, must needs have a large Ventricle. In our Subjects it was not a foot in length, and its greatest breadth, which was towards the Top, exceeded not Six Inches, and two and a half towards the middle, where it was contracted to enlarge it self again in a second Ventricle about three inches and a half, which was raised towards the *Pylorus*. The bottom of each Ventricle was hard and three lines thick, and five towards the *Pylorus*, which was also harder: Their internal Membrane was even, as it usually is, except that little rough.

roughness which we call the Velvet : But it somewhat resembled that of the Ventricle of Animals which Chew the Cud, by reason of several Eminencies which it had, like to those which do make the *Reticulum* and *Echinos* ; but that these Eminencies had not in their shape the regularity which is observed in those Animals,

As to the *Intestines*, it may be said that there was but one, because there appeared not the distinction which is observed in the generality of Animals, by the difference of their Colour, Substance, and Bigness. There was not likewise any sign of the *Cecum* nor its *Appendix*, no more than of the Wrinkles, or Cells at the *Colon*. They were in all Forty Foot long : Where as those of the *Lyon* exceeded not Twenty five. This Uniformity of the *Intestines* may have been the cause of *Theodorus Gazas* putting, in the Translation of *Aristotles*' Book, where he Discourses of the *Intestines* of the *Bear*, the Singular *Intestinum* for the Plural *Εντερα* ; and it is probable that this particularity was unknown to *Scaliger*, when he reproved *Theodorus* for taking this Liberty.

The *Spleen* was small and thin, being not above six Inches long to two broad, and less than one thick.

The Structure of the *Kidneys* appeared to us very excellent and particular. Their figure was very long. They were five Inches and a half in length, and two and a half in breadth. The *Membrana Adiposa*, which was without Fat, being taken away, there appeared another very hard and very thick Membrane, which was not the peculiar one, fastned to the *Parenchyma*, but a Membrane which like a Sack contained fifty six small *Kidneys*, for they may be called so many *Parenchyma* actually separated from one another, covered with their proper Membranes, and joyned together in some places by Fibres and very thin Membranes, which were produced from that which enveloped them like a Sack. This connexion was principally of the little *Kidneys* which are in the Hollow part of this whole heap of *Kidneys* ; For towards the Gibbous part, they were not linked together.

The figure of each little *Kidney* represented a large Basis on the out side, and were pressed together towards the inside of the whole *Kidney*, where they were fastened like a Bunch of Grapes. This *Basis* was in some Hexagonal, in the most Pentagonal, and in others Four-square. They were also different in Size ; but in the greatest part it was about the bigness of a middleing *Chestnut*, in some of a small Nutt. This Heap did represent a *Pine-Apple*, when Ripe.

Each of these little *Kidneys* was fastned, as it were by a Tail composed of three sorts of Vessels, which are the Branches of the two *Emulgents* and the *Ureter*, which entered thro' the Point of the little *Kidney*, which made a dent to receive them, as an Apple receives its Stalk, after the usual manner of the great *Kidneys*. These Branches were disposed so as that of the *Artery* was between that of the *Vein* and that of the *Ureter*, as *Riolanus* has observed, who believes that these Vessels are thus seated, to the end that the *Artery* striking upon the *Ureter*, may incessantly cause the *Urine* to run by its continual beating.

The *Trunks* of the *Emulgent Vein* and *Artery*, which were not bigger than a Quill, were each divided into two Branches, and afterwards into several others, to Furnish and add one to every little *Kidney*, though there were sometimes

two which seemed to be fastened as it were to one single Tail: But that appeared so, by reason that the two Branches which fastened them together did enter into the little Kidney presently after the Division. These Branches penetrated a little farther, and lost themselves in the *Parenchyma*, so that the notable Cavity which the Vessel had when out of the little Kidney quite disappeared; whether that happened by the almost infinite, and consequently imperceptible division, which is made in the little Branches, which disperse themselves through the *Parenchyma*, as *Laurentius Bellinus* thinks it happens to the *Emulgent*s of the Kidneys of Man; or that indeed these Vessels do not pass farther, according to the Opinion of *Higmore*, and that the spongy Substance of the *Parenchyma* presently sucks up and filtrates the Blood of the Artery, to render it to the Vein pure, and separated from its serosity, which runs through the *Papille* into the *Pelvis* of the *Ureter*, like as *Whey*, when the Cheese curdles, leaves the buttery Part, and passeth through the Cheesy part; and even as the Lye which is poured upon the top of the Copper comes through the hole below, after having penetrated the linnen, without any Pipes which do carry and convey it thither.

The Formation of the *Ureters* was different from that of the *Emulgent* Vessel: For a little after its entrance into the Membrane, which like a sack shut up all the little Kidneys, it was enlarged, and its bigness which was about the size of a Quill, increased equally to that of a finger. It was afterwards divided into two branches of this same bigness, which produced others lesser, which supplied a lesser to every little Kidney. This last Branch did never the less surpass in bigness the Branches of the *Emulgent Vein* and *Arterie*, which entered with it into the little Kidney, and it passed forwarder, and nearer to the middle, at which place it was divided into two, and sometimes into three branches. Every of these Branches enlarged it self a little, and at its extremity formed a *Pelvis*, which was filled with a *Caruncle* like a Nipple; and at the side of this *Caruncle* the *Pelvis* appeared pierced with three or four holes, which were only Sinuosities formed by the Membrane of the *Pelvis*, which was wrinkled on the in-side, making as it were other lesser *Pelvis*, capable of receiving only the head of a Pin. These *Papille* or Nipples, which were no bigger than a Grain of Wheat, exceeded in their Number those of the *Papilla* of an Ox's Kidney, which are as large as the end of ones Finger, but which are not in Number above Nine or Ten, whereas there was above a Hundred in every one of the Kidneys of our *Bear*: And it seems that *Bartholinus* had not examined this, when he writt that the Kidney of the *Bear* was like to that of the Ox, of New-born Infants, and of a *Porpoise*, which he dissected before the King of *Denmark*; for these Kidneys of which *Bartholinus* speaks, and to which he compares those of the *Bear*, have only slits in their Superficies, which makes them to appear at the first sight like unto those of the *Bear*, although in truth they have but one simple and continued *Parenchyma*, these slits penetrating not very deep; whereas the Fifty six small Kidneys of the *Bear* were actually divided, and had every one all the parts of which the great Kidneys are composed.

It must be also, that those who like *Pliny* have reported, that the *Penis* of the *Bear*, so soon as it is Dead, grows hard like a Horn, have not seriously examined the Matter, and that they have not had either the Courage to inform themselves, which is the *Penis* of the *Bear* when alive, or the curiosity of

of dissecting one when dead ; for they would have found that this hardness is natural to this part in the *Bear*, as in the *Dog*, *Wolfe*, *Squirrel*, *Weasel*, and several other Animals, which have a Bone at the end of the *Penis*, as *Aristotle* observes. That of our *Bears* was five Inches and a half long, four Lines broad towards the *Ox Pubis*, from which it was five Inches distant, and a little bended.

The Lungs had five Lobes, three on the right side, and two on the left. The two upper on the right side were very large ; the third which was middling, was divided at its extremity into three Points. In one of our *Bears*, the two Lobes of the left side were exceedingly swelled ; the superior which appeared whiteish, was puffed up with a great deal of Wind : In the inferiour there was found a strange Body twice as big as ones fist, like to a Sponge steeped in Ink. In the other *Bear*, which was very young, the Structure of the *Mediastinum* was very particular, being pierced in several places with a great many holes of a Line and a half in breadth, and being interspersed with a great number of Vessels, which were above a Line in thickness, so that it wanted only the Fat to resemble an *Epiploon*.

The Heart which was six Inches long and four broad, was very solid at its Point, the Fleish whereof was an Inch thick ; this Point was blunt and not sharp, as in the *Lyon*.

The *Aspera Arteria* had all its rings imperfect, and not intire as in the first of the *Lyons* which we dissected : But these Rings in our *Bears*, were much larger than in the *Lyon*, being above five Inches in the Circumference.

The Tongue was broad and thin, as in the *Cat* and *Dog*, and furnished at top with its little fleshy Points without any roughness.

The *Cranium* or Skull was not so brittle as Authors do report ; it was found very hard under the Saw. It is very true that it was not above half the thickness of the *Lyons* ; which we found to be six Lines at the thinnest place. The Bone which advanced on the in-side, and which separates the *Cerebrum* from the *Cerebellum* was also thinner, and of a more irregular shape than in the *Lyon*.

The Brain was in recompence four times as big, being four Inches in length, and as many in depth, to three in breadth ; whereas the *Lyon* had but two every way. The *Glandula Pinealis* was very little, and almost imperceptible as in the *Lyon*.

The Eye was covered over with an internal Eyelid, which began at the great *Canthus* or corner tending somewhat down wards. It was strangely late : Its Ball was not above Five Lines Diameter, and was lesser than that of a *Catt*. The *ChrySTALLUS* was almost spherical ; and that of the left Eye of the greatest and oldest of our *Bears* was spoiled by a *Glaucoma* which had made it white, and altogether opaque, its situation was likewise very extraordinary, not being directly placed over the Aperture of the *Uvea* but drawn a side out of the *Axis* of the Eye, so that even before the dissection this was found out by a whiteness which appeared at the bottom of the aperture of the *Pupilla* in the inside, as if there had been a *Cataract* couched : and this was caused by the contraction of the Fibres of the *Ligamentum Ciliare* of one side, and by the extension or relaxation of those of the other ; which seem'd to be made to leave a free passage for the usual Species through both the other humours ;

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this distortion of the *Crystallinus* being probably caused after the same manner as it is seen to happen to the eyes of Children, which having been a long time couched in one place where they can only discern the light obliquely, do grow a squint by a disposition which the muscles of the eye do contract by use, and which changes that which is natural to them, by the extension of the fibres of some, and by the contraction of others. This would make us to think that these Fibres of the *Ligamentum Ciliare* are capable of a contraction and voluntary dilatation, like to that of the Fibres of the muscles; and that this action may augment or diminish the convexitie of the *Crystallinus*, according as the need which the different distance of the objects may make it to have on the Eye to see more clearly and distinctly.

The extream leanness of our two *Bears*, deprived us of the means of making an experiment on their Fat, and of informing our selves of the truth of what *Aristotle*, *Theophrastus*, and *Pliny* do report thereof; that being kept all winter, it manifestly increases in bulk and weight; which being verified would confirm the current opinion, that the *Bear* is of all Animals that in which the Facultie of growing is most powerfull; seeing that being at the beginning of Life almost the least of all (for according to the report of *Aristotle*, and *Pliny*, it is hardly bigger then a *Rat*;) yet it grows one of the greatest: and that though it hath been a long time suckled and feed with milk from a damme which eats nothing, (if it be true as *Aristotle* says, that the *Bear* brings forth its Cubbs when it is ready to shut up it self in its Den, where it remains for ty days without eating, and that afterwards the *Bear* does annually continue a long space without takinge Nourishment,) it ceaseth not to grow so powerfully that according to *Albertus*, its growth like the *Crocodile's* lasts the whole course of its life, and continues even after its death, if what the ancients have writt concerning its Fat be true.

The Consideration of these particulars joyned with our Observations, made us to think that the Temperament of the *Bear*, which according to *Aristotle* is extreemly Humid, must be understood of an Humidity peculiar to Life, which is that which does not easily dry, and which is the effect, not of the Crudity, such as is the superfluous Humidity of the Excrements, but of the perfection of the Concoction caused by the goodness of the Constitution of the parts, which are capable of easily Converting all kind of Nourishment into good juice, and of assimilating and changinge it into their proper Substance, or of dissipating the greatest part thereof by the Employment which they do advantagiouly make of it for the exercise of their Functions.

The Remark's, which our Observations on the *Bear* have afforded us of this perfection of Temper, are first, that an Animal which Eat's indifferently of all sorts of Meat like the *Bear*, and which with the same Facility Digests raw Meats, *Fish*, *Crabs*, *Insects*, *Fruits of Trees*, *Pulse* and *Hony*, and that in a very small Stomach, and strait Intestines, and amongst which there is found no *Cecum*, must have a Wonderful Power for the Concoction; seeing that it is capable of supplying by the goodness of the Temper, that which is wanting in the Commodiouness of the Structure, which is found in the Organs which other Animals have to render these functions more perfect, and which to Digest a great deal of Nourishment, do keep it a long time in great Receptacles, and Convey it through a vast many wrinkles and

anfractuosities, as we have Observed in the *Camel*, whose Intestines were almost as long again as those of the *Bear*, comprehending above eleven *Toises*.

Secondly, the small capacity which is found in its Liver and Spleen to receive the Excrements, denotes also that the action of the Natural Heat is so well regulated, that it is not Subject to the Defects or Excesses, through which the Food being either Burnt, or but half Drest, the Blood which is thereby ingendered hath need of being Purged and Cleared of abundance of parts which are incapable of Nourishing the Body. For as to the great Number of *Kidneys*, when even Nature had made it to Evacuate a greater quantity of Serosity, the abundance of this Excrement ought not to be Esteem'd a Sign of the weakness of the Heat, and imperfection of the Concoction; but rather an Effect of the little insensible Transpiration which is made in the *Bear*, by reason of the thickness of the Habitt of its Body, which is not favourable. To which we may likewise add, that this want of Transpiration cannot be a Sign of the want of Heat, and of an Earthy weight; seeing that how Masse, and Gross soever the *Bear* appears, there is scarce any Animal whose agility and vigour is more capable of shewing the abundance and Subtily of Spirit which the power of Natural Heat, is used to produce.

Thirdly, this so Powerful faculty which it has of growing, is the mark of a very perfect Humidity, seeing that it renders the parts capable of extending themselves, and so of Augmenting their Grandure, without the least diminishing of their forces. The Conjectures which we have drawn from our Observations, to make credible this extraordinary smallness reported by Authors of the *Bear* at its Birth and first Conformation, are grounded upon the littleness of its Eyes, by reason that the Eyes when the Formation is apparent, are commonly so bigg in Proportion to the rest of the Body, that each Eye surpasses in bigness all the rest of the Head, like as the Head do's vastly Exceed the bigness of the rest of the Body: so that supposing as it is rational, that the Eyes of the *Bear* were in the first Formation Proportionably as large to the rest of the Body as they have used to be, it is easie to Judge by the littleness which they have when the *Bear* is arrived at its growth, what was the smallness of its whole Body in the first Formation; or else it would be to suppose a thing incredible, *viz.* that its Eyes have not grown and increased proportionably to the rest of the Body, as in other Animals.



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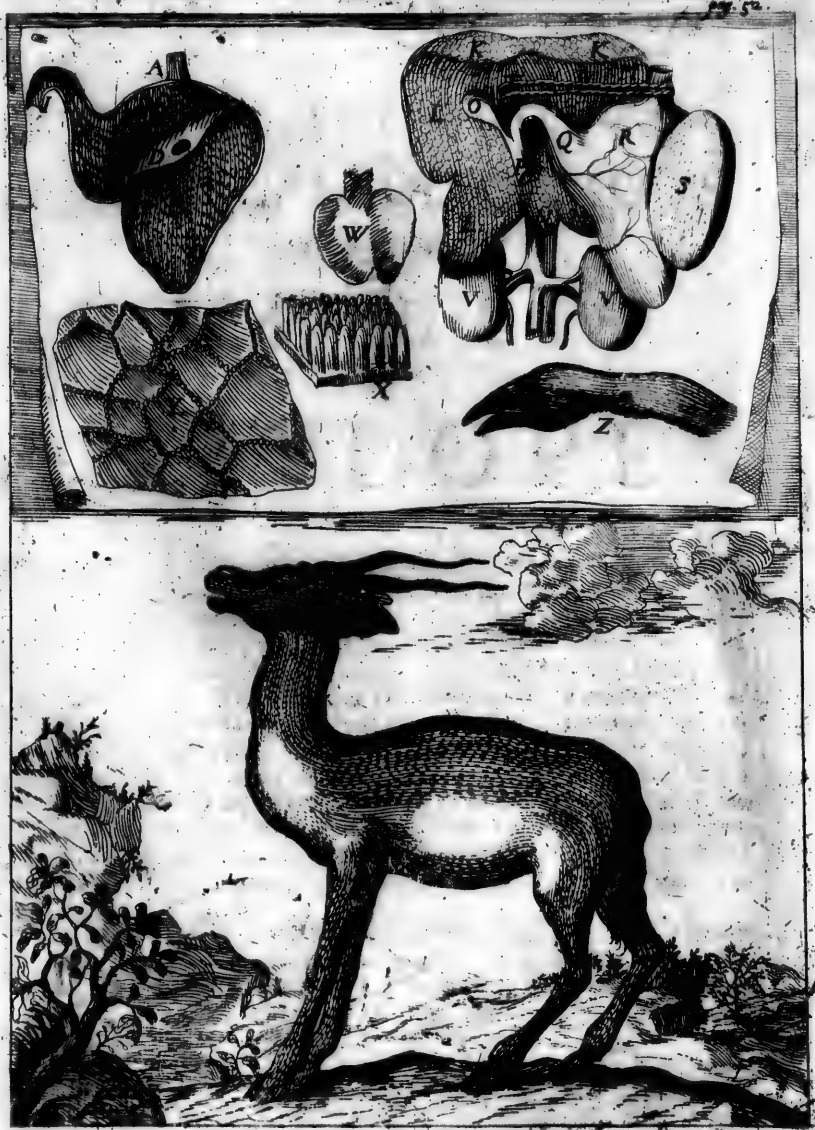
The Explication of the Figure of the Gazella or Antilope.

That which is discribed in the lower Figure has no Black list, which separates the Fawn-colour of the Back from the White of the Belly, and the Knees of the Fore-leggs are not bare and Hair-less; because that these are Particulars which were wanting in Four of the *Gazella's* which we dissected. There was one also, which was the Male, whose Horns were more bent towards the Back than they are in this.

In the Upper Figure.

- A. *The Oesophagus.*
- B. *The middle Membrane of the great Ventricle.*
- C. *The internal Membrane.*
- D. *This Membrane separated, to discover the part underneath.*
- E. *The Valve which shuts the second Ventricle.*
- F. *The first part of the second Ventricle.*
- G. *The lower part of the second Ventricle.*
- H. *The Sack of the second Ventricle.*
- I. *The Pylorus.*
- KK. *The Gibbous part of the Liver raised up.*
- L L. *The right Lobe.*
- MM. *The Left.*
- N. *A Little Lobe which is in the middle.*
- O. *The Gall-Bladder.*
- P. *The Duodenum.*
- Q. *The Pylorus.*
- R. *The outside of the Ventricle.*
- S. *The Spleen.*
- T. *The Two Lymphaticks.*
- V V. *The Kidneys,*
- X. *Part of the Membrane B, seen with the Microscope.*
- Y. *Part of the Membrane C, seen with the Microscope.*
- z. *The last Bone of the Sternum.*
- W. *The Cartilago Xiphoides.*
- Z. *One of the Feet.*

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THE
ANATOMICAL DESCRIPTION
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THe five *Gazella's* or *Antelope's* of which we do give the Description, were brought to us at divers times. There was one Male, three Females, and a Fawn, which was likewise a Female. The first which we dissected, which was the largest and oldest, was brought us with its Fawn, from the Park of *Versailles*, where it was told us, that they had been both killed by another Male *Gazella*. We found that the left Shoulder of the Damme was all bruised, and that the Fawn had three Leggs broken. This made us to reflect upon what *Belonius* says, *that the Gazella is the Oryx of the Antients*, which *Oppian* represents as an Animal strangely fierce and cruel: But we found not the other Marks, which according to Authors are peculiar to the *Oryx*; as to have one single Horn in the middle of the Fore-head, as *Aristotle* says; to have all the Hair turned towards the Head, according to *Pliny*; to have a Beard on the Chin, as *Albertus*; and to be strong enough to Fight Lyons and Tigers, as *Oppian* relates.

Our *Gazella's* had a very mild carriage, and it is said that these Animals grow not angry, unless when touched on their Horns. The Arabian Authors do call the *Gazella Algazel*, that is to say, a Goat; and it is most probable the *Dorcas*, or *Lybick Goat*, which is no other but the *Strepsiceros* or *Wild-goat* of *Egypt*; although *Scaliger* pretends, that the *Strepsiceros* is a Species of *Sheep*. *Alian* Reports, that the *Lybick Dorcas* is light of Foot, that its Belly is White, and the rest of the Body of a Fawn-colour; that the White and Fawn-colour along the Flanks is separated with a Black List; that it hath Black Eyes, and huge great Ears. The *Strepsiceros*, according to *Pliny* is an *African Goat*, which hath the Horns elevated on the Head, very pointed, round

incompact round with several wrinkles, and bended like the Branches of an Harp; or rather as *Joannes Cajus* understands it, that they are bent sometimes outwards, and sometimes inwards, so that they do describe the *Profile*, and wreathing of a *Guitarne*: But it may be questioned whether the *Lyra* of *Pliny's* Time were of this Form.

All these Marks being found in these five Animals which we dissected, it may be said, that the *Strepsiceros*, *Dorcus*, and *Gazella* are the same thing; for our *Gazella* is an Animal of *Africk*, which seems to be a good Runner, if it may be guessed by the length of the Legs. It was about the bigness and form of a *Wild-Goat*, with Fawn-coloured Hair, except the Belly and Stomach, which were White, the Tail which was blackish, and a List somewhat more Black, like as the rest of the Hair from the Eye to the Nose. The Hair better resembled that of a *Wild-Goat*, than that of a tame one, being very short: Under this Hair the Skin was perfectly Black, and shining in that which was the oldest; in the others it was Grayish; and this Blackness appeared very plainly in their Ears, which were large and not hairy on the in-side, where the Skin was Black and smooth like *Ebony*, having only some streaks of Hair very White, more stubborn and longer than that of the Belly; These streaks or rows proceeded from the bottom of the Ear, and grew larger towards the Edges. The Eyes were large and black; the Horns were likewise Black, radiated cross-wise, fifteen Inches long, ten Lines broad at the Bottom, very pointed, pretty strait, but somewhat turned outwards towards the middle, and which did afterwards bend inwards again, according to the shape of the Branches of an Harp, such as is seen in some Ancient Sculptures. Those of the Male were a little more bent backwards. In the Four Females they were round, but the Male had them somewhat compressed and flattened, which hindered them from being perfectly round; and it may be said that this roundness of the Horns has given to the *Gazella* amongst the Ancients the Name of *Strepsiceros*, which must rather signify Horns wreathed about, than bent as those of all other Goats usually are; this one sort of roundness being peculiar to the Horns of the *Gazella*, amongst the *Goat-kind*, (supposing it to be a Species of *Goat*) because that the other Horns of these Animals are of Angles and Planes, like those of all Sheep, except that of *Candia*, which hath round Horns, as *Belonius* observes, who says, *that even in his time it was in the Country called Stripoceri*; which might well be the reason that made *Scaliger* to say, *that the Strepsiceros is a kind of Sheep*.

These Horns were hollow half way, and filled with a pointed Bone, which fastened them to the Head by the means of a *Pericranium* which covered it. This *Pericranium* was very hard, thick, and moistened with a great deal of Blood, like as the in-side of the Bone, which was spongy like the *Diploe*: The external Superficies of the Bone being very solid, and streaked with some Furrows according to its length, contrary to the Furrows of the Horns, which were transverse, as hath been declared. At the root of these Horns there was a Tuft of Hair longer than that of the rest of the Body.

The Nose was a little flattish like to the *Goats*, but yet more in the Male than in the Females, for its Nose was shorter, as it usually is in the generality of Brutes, where the Males have the Head always rounder than the Females.

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The Palate was covered over with a very hard Skin, like long Scales. The *Dentes Incisores*, which were wanting in the upper Jaw, because that this Animal chews the Cud, were eight in the lower Jaw, very keen and of an unequal size; the two foremost being as large as the other six whose breadth went taper-wise, and being likewise a great deal larger at either end than towards their Root.

The Tail in the Females had long and Blackish Hair. It was flat at its Origine, and about two Inches large towards its first Knotts, and was contracted and reduced to one; at the place where there grew long Hair which hung down to the Hammes. The Tail of the Male had not this long Hair which in all the Females resembled that of a Mans Head; it was only a little longer than that of the rest of the Body and softer than that of the Tail of the Females.

The Fore-leggs upon the bending of the Knee were covered with Hair somewhat longer, and harder than on the rest of the Legg. It was layd and turned half on the right side, and half on the left, like the feather of a Horse; and in this place the Skin was a great deal thicker than elsewhere; which made it a kind of a little Cushion to kneel on, like the Callosities which are on the Knees of the Camel. The *Gazella* which *Fabius Columna* describes, better resembled the Camel than ours, for it had this place wholly deprived of Hair.

The Foot, which was a great way Cleft and fortified with two great Hoofs, besides the two little ones at the Heel, like the foot of the *Wild-Goat*, had this also resembling the feet of the Camel, that it rested half upon the Hoof, which only fortified the forepart, and half on the Skin, which in the hinder-part covered a round, and much thicker Flesh than is on the Feet of *Staggs*, *Wild-Goats*, and other Animals which have Cloven Feet. And this Flesh is probably more fitt to walk upon the Sands of *Lybia*, than on the Lands of other Countrys which are Stony, as we understood by the Feet of one of our *Gazella's* which was much swelled, for having been hurt in this tender part unprovided of a Hoof.

We Observed also that these Feet are Cleft after a particular manner, because that the two Hoofs, which might be moved a great way from one another, were joyned by a Skin which was very easily extended: Which made us to doubt whether the *Gazella* might not be the Animal which *Ælian* reports to be by the Greek Poets called *Kemas*, to which he gives a great many Marks which are seen in the *Gazella*, but amongst other things he says that its Feet, which are like to those of a Goat, are so Formed that they do help it to Swim. This Skin was shorter in the Feet of the Male, whose Hoofs opened not so much as in the Feet of the Females.

Our *Gazella's* had but two Teats, which had each but one *Papilla*. On the side and underneath the Teats there was in the *Inguina* or Groins two Cavities like Sacks not very deep, where the Skin was without Hair, as it is about the *Papilla*; but this Skin was not so sleek, being rough and like a Barley-Corn. These Cavities were filled with a Substance like Wax: Which may have occasioned the mistake of *Ioannes Agricola Ammonius*, who has taken the *Civet-Cat* for a *Gazella*, by reason of the Baggs which the *Civet-Cat* has to contain its Sweet Smelling Liquor; the *Civet-Cat* and *Gazella* being otherwise Animals altogether unlike, and these Cavities or Sacks which are seen

in the *Gazella*, do much more resemble those which *Hares* have in the same place, than those of the *Civet-Cat*. The Male had these Cavities or Sacks as well as the Females.

All these Particular Circumstances which we observed in these Females, were only in three of our *Gazella's*; the fourth differed from the rest, in that it had no Cushion on the Knees, although the others much Younger had it; but it had not this place bare like that of *Fabius Columba*, which it otherwise resembled, by reason that it had this Black Lift along each Flank, which *Alian* has observed in the *Lybian Dorcas*: The Male had also this very Lift.

AS to the internal Parts, the *Epiploon* in all the five *Gazella's* was furnished with a hard and Reddish Fat, which covered and inclosed almost all the Vessels which are in this Part, by following and accompanying them into all their divisions. This *Epiploon* Swam not upon the *Intestines*, but Enveloped them behind, except in one of our Subjects in which towards the left side the *Ilum*, was fastned to the *Peritoneum*, by a great Number of Fibres. In the others it descended from the anterior and middle part of the Ventricle to which it was fastned, and passing into the bottom of the lower Belly, under the greatest part of the *Intestines*, came to fasten it self to the Center of the *Mesentery*, and Ascending higher, returned to the lower Part of the Ventricle. The *Cartilago Xiphoides* was four times bigger in Proportion than it is in other Animals, being an Inch and half in Breadth, and spreading out of each side of the *Sternum* to which it is fastned, and turning it self round to end in a double obtuse Point. The Liver, as to its Figure and Shape, was very like to a Mans, being divided into two great Lobes, besides which, there were two lesser, one whereof, which was the least, was extended to the right Kidney, which it half covered; the other was in the middle upon the Spine. In the hollow part of the *Fenn's* Liver there were two Lymphatick branches about the bigness of a Line. They appeared as it were very full of knots, by reason of the inequality which an almost infinite Number of *Valves* afforded them in the contracting them; so that like little Beads of *Chrystall* they fastned the Trunk of the *Vena Porta* to the superior *Orifice* of the Ventricle.

The Substance of the Liver appeared to us very particular, being as it were composed of an infinite Number of little Glands, some bigger, and others lesser then *Hemp-seed*. They were of a much paler Red than that which joyned them together. These Glands seemed every one pierced thro the middle, by reason of a little Red slit which they had, out of which there came blood when they were pressed. That which parted them one from the other was of a Red like to that of the small slits, but this part did not bleed. The Glands of the hollow part were much larger then those of the Gibbous.

Dr. Malpighius a Phisitian of *Messina*, who is of opinion that all the *Parenchyma's* are composed of several Glands, explains not how he observed that the Livers, which do generally appear of a continued and Homogeneous Substance, are indeed divided into several parts separated from one another, nor of what bigness they are: for when he says that these Glands do resemble Grapes, upon the bunch, it may be doubted whether these Grapes do signifie the figure or bigness of the Glands, which he neuertheless owns to be Hexagonal in the Liver of *Cats*, and different in every Animal.

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We were of opinion that it might be, that the Glands which did compose the Livers of our Gazella's were grown apparent by some Distemper, because that they were much more visible in some than in others, and that there was one of our Gazella's where these Glands appeared not at all, and in which the Liver was found with a *Parenchyma* even homogeneous, and continued as usually; so that there is ground to believe that these Glands, which when the Animal is in Health, are spongy and imbued with the Blood, which is in all the *Parenchyma* of the Liver, do not seem to be separated from one another, as they do appear, when being hardened by the Distemper, and by reason thereof receiving less Blood, their different Substance makes them more distinguishable, by the diversity of Colour, which in the glandulous Part is whiter for want of Blood, and redder in that which is between the Glands, by reason of the Blood there contained.

But that which confirms *Malpighius's* Opinion, is the regular Figure which we have observed in these Glands, which is always near the Hexagonal, and the little chincks or slits which all had in their middle: for that demonstrates, that it is not when the Liver is hardened by a Schirrous and preternatural concretion of its Substance, fortuitously amassed into several Lumps, as it happens to Oyl when it is frozen, but that every Gland by condensing has preserved its natural Figure.

The Spleen was oval, very small, all fastened and joyned to the left side of the Ventricle, except about a Fingers breadth of the fore-part, which was separated there-from; so that the Vessels commonly called *Vas brevis*, which are ordinarily the band which fastens the Spleen with the Stomach, appeared not, being confounded and hid in the Membranes of one or other of the *Viscera*. In all the five the Spleen was of a Violet-colour at top, Blew underneath, and all over speckled with White Spots, which might be taken for Glands like those of the Liver, were it not that they were of a regular shape.

The Gazella, which is an Animal that chews the Cudd, has but two Ventricles, which do appear very distinct and separated from one another by considerable Contractions, such as is seen in other Animals that chew the Cudd. But the truth is, that in our great Gazella, these two Stomachs were more distinguished, than the four are in other Animals; for besides the Contraction and different qualities of the Membranes, which do generally make the distinction of the four; there was a Valve which separated these two, and in the Membranes which did compose them, we found all the various Figures and particular Substances, which the four used to have.

The first and largest which receives the Nourishment immediately from the *Oesophagus*, was very ample and large at the top, and its Figure was pointed at the bottom. It was covered on the in-side with two Membranes layd one upon the other, which are those, with which are separately covered the two first Stomachs, which in *French* are called *Panse* and *Bouvet*. These two Membranes were very easily separated one from the others. The exterior, which made the internal Superficies, which is that which is proper to the *Pansa* or *Paunch*, called by *Aristotle* *Kardia mesogaster*, was like a Velvet composed of an infinite number of little Particles, having the form of *Papilla*, which were three times as long as bigg; and this Bulk exceeded not that of a middle-sized Pin. The other Membranes which were under

this first is that which is proper and peculiar to the second Stomach, by *Aristotle* called *Κεραυραλός*, and by the *Latins*, *Reticulum*, by reason that it has some Eminencies which do represent a little Net, which has made this Stomach to be called *Bonnet*, because that this Net resembles the lace Bonnet, in which Women heretofore inclosed their Hair. These Eminencies like a Net were as it were ingrailed, and bordered with little grains.

This great Stomach, which we do reckon but one, because that its two different Membranes were extended equally, and after the same manner one over the other through its whole Capacity, may nevertheless appear double, in that its superiour part, which was much larger than the inferiour, was in some sort separated by a Contraction, but which was very inconsiderable.

At the top of this great Stomach towards the right side, where it contracted like a *Pylorus*, there was an Orifice or Aperture which was the passage to the second; and this Aperture was closed by a Membrane, in form of a great Valve, made like a little Sack, to hinder that which is once got out of the great Stomach from re-entering therein. This second Stomach, from its entrance to its middle, was like to the third of *Oxen* and *Sheep*, by *Aristotle* called *Εγύς*, by the *Latins* *Omasum*, and in *French* *Millet*, because that it is full of leaves disposed lengthwise, which are bordered with little Eminencies like grains of *Millet*, which appeared rough and full of points to those who have given it its Greek name, which signifies an *Hedgehog*. This roughness which went half way decreased insensibly and not all at once. The colour of this first part of the second Stomach was likewise different from the first great Stomach, in that it was of a Red inclining to a Purple, whereas the first was white as usually.

The second part of this Stomach was much larger than the first, and it resembled the fourth of other Animals that chew the Cud, called by *Aristotle* *Βρυγών*, by the *Latins* *Abomasum*, and by the *French* *Caillette*, because that it is in this Stomach that the Runnet is made which makes the milk to curdle. It had also some inequalities and Eminencies like leaves, but which were smooth and polished. Moreover it formed at its entrance a great Sack, by the means of a fold which it had underneath the first part of the second Stomach; and towards its passage out it was raised upwards and contracted to make the *Pylorus*. This Structure of the two Stomachs which was found the same in all the Females, was something different in the Male, where the first and great Stomach was not pointed at the bottom; and altho its two Membranes were separable as in the Females, yet the under one had no Network folds, nor any Valve at the entrance into the second Stomach, which had an Eminence or Bunch which was wanting in Females.

The Intestines of the Females were disposed in such a manner that the *Jejunum* and *Ileum* were plaited very small through several little Cells, and fastened along the *Colon*, which served them as a band to stay these plaits or folds like a Ruff. The *Cecum* had no Cells: The *Ilia* or small guts were almost four lines diameter, the *Colon* above six. The Intestines of the Male had their *Appendices* in another manner; for some were folded as the *Colon* in a Man, making a great many little Cells: others were doubled longways like a Trumpet, each fold being above four inches long.

The branches of the *Vena Mesaraica* were very large, and fattened to the Colon by abundance of little branches, which they sent thicker; and every great branch passing a little farther did in like manner distribute little branches to the Small Guts.

The *Cecum* was seven inches in length and one in thickness.

The *Kidneys* were almost round. The right lay under the little right Lobe of the Liver, and the left under the Point of the Stomach. The situation of those of the Male was very extraordinary; for the left was upon the *Aorta*, and the right was two Inches higher than the left.

At the Origine of the right *Spermatick Artery* of the Male, there was a Glandulous Body placed upon the Trunk of the *Vena Cava* as if it were a Cushion to this *Artery*.

The *Uterus* was divided into two *Cornua*, as in other *Bovines*. On the inside it had abundance of Eminencies like *Papilla*, seven or eight in each Horn, and at the Internal Orifice there was a *Caruncle* in the inside which covered it.

There were two large Vessels which went to the Dugs. The Vein which was the larger directly tended to the *Papilla*, always keeping its same bigness, and suddenly disappearing, without casting forth any apparent Branches. The *Artery* ran down to the Bag which is near the *Papilla*, where it was divided into five or six Branches, like a *Gooses Foot*.

The *Lungs* had four Lobes on the right side, and two on the left. In one of the *Gazella's* they were all sticking fast one to the other, and to the *Ribbs* and *Diaphragme*, to which the Liver was so fastned, that its *Parenchyma* was there tied, and would sooner tare than separate.

In this Subject the *Vena Azygos* was as large as the *Vena Cava*.

All our *Gazella's* had the Heart long, and Pointed, that of the largest being four Inches and a half in length, and two and a half in breadth. The Ventricles of the Heart of that which Dyed with the blow, which had bruised the Shoulder, were almost filled with a hard and Solid Flesh, which was a Body strange, and separated from the Substance of the Heart, and of its Vessels. The *Pericardium* was immediately Knitt to the *Sternum* and *Diaphragme* by two strong Ligaments. The Point of the Heart was turned towards the *Cartilago Xiphoides*.

The *Brain* had few *Anfractuosity's*, and was but lightly slit, and divided in two, at the place of the *Falx*. The two upper *Ventricles* were open one into the other in the Anterior part of the *Septum Lucidum*, by an hole two thirds of a Line in breadth.

The Ball of the Eye which was very large being an Inch Diameter, was covered with an internal Eye-lidd: The *Cornea* was Oval. The *Uvea* was of a Greenish pearl Colour, and the *Retina* was in this place Crossed over by the Branch of a Vein which shot forth several Branches; The whole being full of a Blackish Blood. The Branch was about the bigness of a great Pin, and it was got into the thickness of the *Retina*.

The Explication of the Figure of the Cat-a-mountain.

IN the lower Figure it may be observed that this Animal is altogether like a *Cat*, except that it has proportionably a shorter Neck, and the Tail much less. In this it differs also from the *Leopard*, which has a Neck long and slender, and a very large Tail, as Naturalists do describe it.

In the Upper Figure.

A A. The bottom of the Ventricle.

B B. The Vena Gastrica.

C C. The Membrane which holds together the two Orifices of the Ventricle.

D. The Spleen.

E. The Trunk of the Vena Cava.

G. The Trunk of the Aorta.

H. The upper Mesenterick Artery mis-called the Lower in the Text.

I. The Veins and Arteries of the Lungs.

K K. The Ureters.

L. The Bladder.

M. A Vessel which may be taken for one of the Deferentia.

N N. The Prostate.

O O. The Kidneys.

P. The Penis.

Q Q. The proper Membrane of the Kidney.

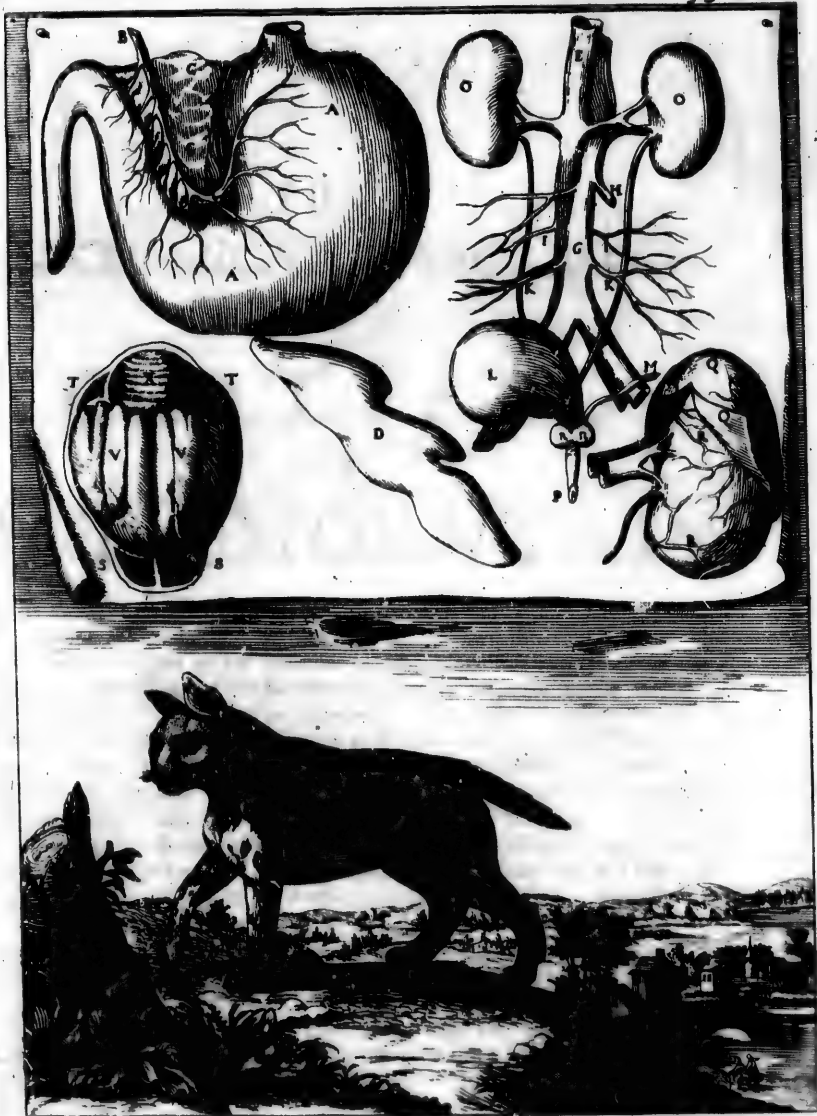
R R. Some Vessels appearing on the outside of the Kidney is self.

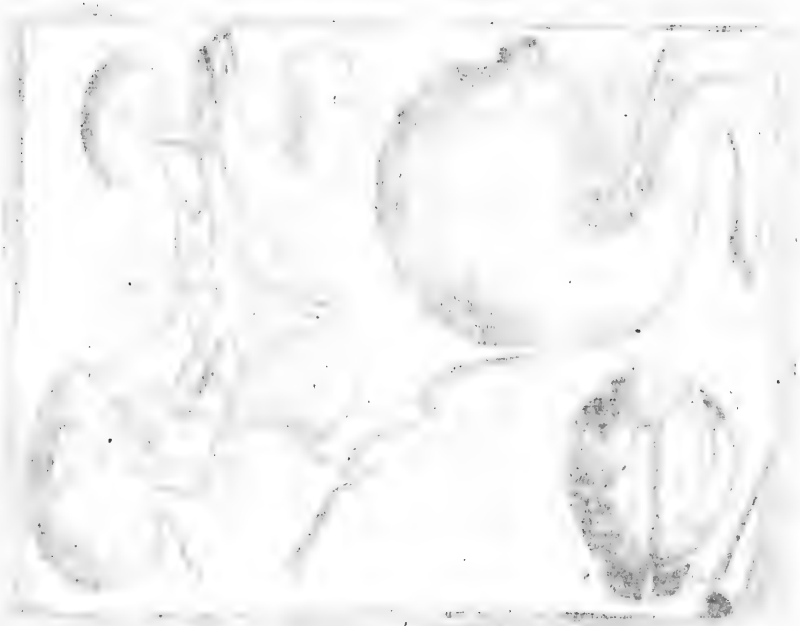
S S. The great Sinus's in the Os Frontis.

T T. The two other Sinus's in the Os Occipitis.

V V. The Brain.

X. The Cerebellum.





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THE
ANATOMICAL DESCRIPTION
OF A
CHAT-PARD
OR,
CAT-A-MOUNTAIN.

It is thought that the *Chat-pard* or *Cat-a-mountain* is one of those Animals which are ingendred by the mixture of two different Species; and that it ought to be put in the number of the Novelties which *Africk* daily produceth; according to the Opinion of *Aristotle*, who giving the reason of the Fertility which *Africk* has for Monsters, says that the dryness of its Desarts compels the Savage Beasts to Assemble at places where there is Water: And he supposes that this meeting occasions these different Animals to couple, and ingender a new Species, when it happens that they are equal in size, and the time which they used to bear their young is not very different.

But according to these reasons of *Aristotle*, the Animal which we speak of seems not possible to be ingendred of a *Leopard* and a *Cat*; nor of a *Cat* and a *Panther*, which according to the most common Opinion is the Female *Leopard*, for neither the Stature of these Animals nor the times during which they go with Young are alike; the *Leopard* and *Panther* being Animals a great deal larger, and of a Species which carries its young much longer than *Cats*.

Our *Chat-pard* was but two foot and a half, from the end of its Nose to the beginning of the Tail. It exceeded not one foot and a half in height, from the top of the Back to the end of the Fore-claws: The Tail was but eight inches.

There was nothing in all its exterior Figure which is not in a *Cat*, save that its Tail was not long enough in Proportion to the rest of the Body, whose Bulk did indeed surpass that of the largest *Cats*, but was also much inferior

to that of the *Leopard* and *Panther*. It had no long and slender Neck like those Animals? It was on the contrary in some sort shorter than the *Cats*; which we found to proceed in some measure from its extraordinary fatness.

But in this it seemed to us repugnant to the nature of the *Leopard*, which according to *Gallen* is the leanest of all Animals, unless it be supposed that our *Chat-pard* was ingendred of a *Leopard* and a *Cat*, and not of a *Cat* and a *Panther*; because it is observed that commonly when there is a mixture of *Species*, that which is thereby ingendred has more resemblance to the *Damme* than the *Sire*, especially in that which respects the Form and Habit of the Body.

The grossness of the body of the *Hair*, was proportionably of the length as it is in *Cats*, but it was somewhat shorter. The *Colour* which most prevailed all over the Body was of a *Fox-red*; only the belly and inside of the fore-legs was *Isabella*, the Throat and bottom of the lower Jaw was white. There were black spots all over, along ones upon the Back, and round ones on the Belly and Feet, at the extremity of which the spots were very small, and thickly seminated; on the Ears there were some very black streaks which crossed them; and in short, they wholly resembled those of a *Cat*. The Hairs of the Beard were shorter than those in *Cats* proportionably to the Body; and there was none on the Eye-brows and Cheeks, where *Cats* have them.

In opening the Belly there was found an extraordinary quantity of Fat, for all the intervals of the Muscles of the lower *Venter* were filled therewith; and under the *Peritonæum* there was a piece which was bigger than ones *Fist*, which inclosed the *Vena Umbilicalis*. The two Skins or Coats of the *Epiplon*, which were likewise furnished therewith, did jointly descend as usually, and reached into the Groin; and folding themselves under the Intestines, did embrace and keep themselves suspended as in a Sack.

The *Intestines* were almost all of an equal bigness, and had two thirds of an Inch diameter. The *Rectum* and *Colon* exceeded the other in bigness only one third of an Inch. These two great Intestines together were twelve Inches long; the others from the *Pylorus* to the *Cæcum* about seven foot. The *Cæcum* was an Inch and a half in length, and two thirds of an Inch in its greatest thickness. It terminated in an obtuse point.

The *Stomach*, which was very great and large, had in the sinuosity, which is in most Brutes between the superiour and inferiour Orifices, a Membrane greatly loaden with Fat, which joyned these two Orifices together, and which conducted the trunk of the *Vena Gastrica* to the bottom of the bending, without touching the Membranes of the Stomach; the *Vena Gastrica* being in this Membrane after the same manner as the Vessels are in the *Mesentery*, and casting its branches into the Stomach as the Vessels of the *Mesentery* do cast them into the Intestines, or as the *Vas breve* produces them to insert them at the bottom of the Stomach, and in the Spleen.

The *Pancreas* was fastened, and run along the *Duodenum* and *Ileum*, and advanced not far underneath the Stomach.

The *Spleen* was four Inches long, and fifteen lines in its greatest breadth. It was of a dark-red colour, and its Figure very well represented that of an Oak leaf, being slit in several places.

The

The *Liver* was divided into six great *Lobes*, three whereof were indented in several places. Its *Substance* was soft, and seemed to be composed of several *Glands*, as we have already remark'd in the *Liver* of the *Gazella*. This was found by two different Colours which were seen in this *Liver*; the bottom being black and spotted with a clear and yellowish red. But these spots had not a regular Figure like those which have been observed in the *Liver* of the *Gazella*'s.

The *Gall-Bladder* was in the greatest *Lobe* of those which were again divided in two: its Colour inclined to Yellow. Its size was proportionable to that of the whole Animal, like as the *Kidneys*, whose proper Membrane was easily separated, altho' the Vessels which were numerous extended on the external Superficies of the *Parenchyma*, and which were very large and swelled, appeared through this Membrane, even as if it had been closely joyned to the *Parenchyma*: for these Vessels were so visible, that they seemed to appertain to this Membrane, altho' indeed they were included in the substance of the *Kidney*, which has been already remark'd in the young *Lion*.

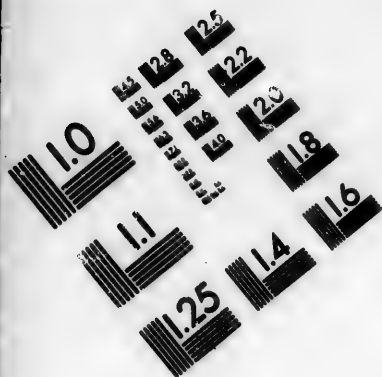
As for the Parts of Generation they were very defective and imperfect; for except the *Penis*, *Prostate*, and *Caruncula* which is in the *Urethra*, there appeared not the least sign or remain thereof. There was only a Vessel which might be taken for one of the *Deferentia*; but it was impossible to know certainly whether it was really one, because that there was no appearance of *Testicles*, and it could not be discovered from whence it came. As to the other *Spermatick* Vessels, there could none be found, altho' sought after with all possible care: for it was doubted whether they were not broken through carelessness, as it is probable *Hofmannus* did, when he Dissected a Woman in whom these two *Spermatick* Arteries were not found, although she had had several Children. To clear this doubt, the *Vena Cava* was pressed, and the Blood therein contained made to ascend from the *Iliack* branches to the *Emulgent* Veins. The same compression was likewise made on the left *Emulgent*, without getting out one drop of Blood, which was there very abundant, and free from coagulation. The great Artery was likewise tied a little below the *Emulgent*; and having blown into the Trunk there went not out any wind. 'Tis true, that having tied the Trunk above the division of the *Iliack* Arteries, the wind lost it self through the Superiour *Mesenterick*, which was broken: but this branch being tied, the Air found no way out when blown, and when the whole Trunk was swelled up.

This defect of the *Spermatick* Vessels and other parts which are absolutely necessary for Generation, agreed very well with the abundance of Fat whereof this Animal was full, after the manner of all those which by an external cause have been rendered incapable of Engendering, and in which the remainder of the nourishment could be employed only to produce Fat.

This gave us some suspicion that our *Chat-pard* might have been Castrated when young, according to the Custom which the *Turks* have followed, as much as they could, towards all the Males which they do keep in their Houses, where they do frequently nourish these *Chat-pards*, especially in *Barbary*, there being some appearance that the *Spermatick* Vessels might have been consumed and effaced by age, even as the *Anastomoses* of the Heart are in Animals

imals





imals of a short time after their Birth, when these parts wanting Action and Use, do wax dry and utterly Abolish. But the truth is, that we found not any Cicatrice in the Skin, of the Belly; and considering that the *Umbilical Vessels* do still remain, altho contracted, when they do no more execute the Functions for which they were employed before the Birth; and that the *Spermatick Vessels* serving for other uses than Generation, have no reason to dry up for want of Employment, when that, for which they were principally designed comes to cease, seeing that it is ordinarily seen that as they pass they shoot forth several branches for the nourishment of the adjoining parts; we remain in our former Opinion, that this defect of such important Organs must proceed from some other part, and that the Sterility which is common to some Animals which have been ingendred by the mixture of two different Species must have a particular cause in our Subject. For that which renders *Mules* Barren is not the defect of any of the Organs which are necessary to Generation, seeing that the difference which may be found in the Conformation of the *Matrix* of *Mares*, and that of *She-Asse* cannot, as some pretend, be the occasion of Sterility; the *Mare*, in which something is wanting that is found in the *She-Asse*, being not deprived of any of the parts which are absolutely necessary to Generation, seeing that she ingenders; and the difference of the Organs which is between the Species of *Horses*, and that of *Asses*, hinder's not the Generation of *Mules*, which do proceed from the mixture of these two Species.

Therefore *Aristotle*, according to *Empedocles*, attributes this defect only to the Temper of these Animals, whose parts have contracted a hardness which renders them incapable of contributing to a new mixture; which this Philosopher explains by the comparison of *Copper* and *Tin*, which being separately very Ductile and Malleable to be employed in different and several works, are no more in a condition of being welded and receiving a new form, by reason of a brittle hardness and sharpness, which the Mass composed of these two Metals acquires, when they are melted together.

So that if it be true that the *Lupi Cervarii* or *Ounces*, which are thought to be engendred of the *Wolf* and *Panther*, as *Mastives* of the *Leopard* and *Bitch*, and the greatest part of the other Animals which are born by the mixture of two Species, cease not to be fertile; it must be thought that the Conformation of our *Chas-pard* was particular and accidental to it; and that the defect of the Parts which are wanting, and which made it incapable of Generation, proceeded not from this mixture of Species, which by changing the Conformation of the Parts could not corrupt it to the degree of rendering it useless to the Functions, and which is still less capable of making a Mutilation; but which may more easily cause a vice in the Temper, which is a consequence very natural from the mixture; and in fine, it is probable that if the *Mule* be the only Animal which the confusion of Species makes Barren, it must needs be that there is something particular in those which have ingendred it, which is not found in the others. 'Tis that which *Aristotle* has observed in the *Horse* and *Ass*, who hath both much less power for Generation, than all other Animals, seeing that in this *Genus*, which consists of those which are short-lived, and which ought consequently to be more readily engendred, the Females do carry their Conception a great deal longer, and have much more difficulty

difficulty to give it its last perfection than others, by reason, as this Philosopher says, of the hardness of their *Uterus*, which is like an Earth which Drought and Aridity have made sterile.

For this being so, it is found that the *Mule* is *Barragenos* only by the general reason of the repugnance which is always found in the mixture of different *Species*, but likewise by the particular defect which was in both of the *Species* which are assembled for Generation, and which have not surmounted that repugnancy so powerfully as *Leopards*, *Dogs*, and *Foxes*, which are Animals fertile enough, to transmit to their Posterity the powerful dispositions which they have for Generation, notwithstanding the contrariety which the mixture of different *Species* may cause.

The *Penis* was extraordinary small, containing from the swelling of the *Ischium*, which is its Origine, to the end, but an Inch and half, and but a Line and half in Diameter. There was found no Bone.

The *Diaphragme* was very fleshy, and its nervous part very small. The *Pericardium*, in which there was no water, was exceeding close to the Heart, which happened perhaps by the swelling of this part, which after the manner of all things that do congeal, was puffed up. For this Dissection was made the eleventh day of *January* 1670. at which time was felt a greater cold than ever was known. The *Ventricles* of the Heart were filled with great plenty of congealed and hardened blood, which was not in the Veins, perhaps by reason of its little quantity, which easily thaws in the parts which must necessarily be much handled in the Dissection and Preparation thereof. The Heart was rounder and less pointed than in *Cats* and fierce Beasts, by reason, as it is probable, that the extraordinary distention and enlarging of the *Ventricles* had made the point to shrink towards the Basis.

The *Lungs* had eight Lobes, four on the right side, three on the left, and the eighth in the middle, in the cavity of the *Mediastinum* joyning the *Diaphragme*.

The *Os Frontis* had two very large *Sinus's*, which were square and long, adjoining to each other. There were two other *Sinus's* in the *Os Occipitis*: they were of a triangular form, and distant from each other, being of the right and left side of the *Cerebellum*. The Bone which separated these two Brains had two points.

The *Brain* was divided in two by the *Falx* which was very large, and which did enter very deep therein. The *Anfractuosities* were extended in length from the *Cerebellum* to the fore-part. At the place where the *Glandula Pinealis* usually is, there was found only a little point about the bigness of a pins point, which was taken for this Gland.

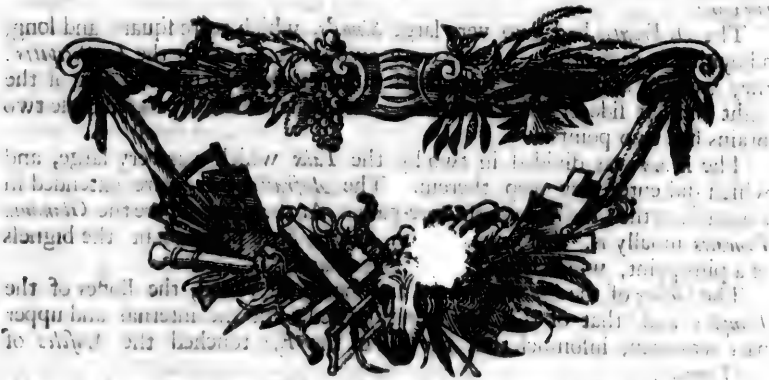
The *Orbite* of the *Eye* was whole and bonie all round, the Bones of the *Temples* and that of the *Jaw* being joyned: but the internal and upper part was open, insomuch that the Ball of the *Eye* touched the *Muscles* of the *Temples*.

The Ball of the *Eye* contained eleven Lines in Diameter through the middle; the *Cornea* had nine. There was an Internal *Eye-lid*, which was seated in the great *Canthus* of the *Eye*, and which advanced towards the little one.

The *Aqueous Humour*, which was in exceeding great abundance, was not found congealed, although the *Vitreous* and *Cryſtalline* were hard Frozen: which demonstrates that this Humour is improperly called *Aqueous*, and that its Substance is rather Spirituous and as it were *Eſherial*; because that Congelation peculiarly belongs to Aqueous Liquors; those which are Fat and Oleaginous being capable only of Coagulation, even as those which are Spirituous and Aetherial do suffer neither Congelation nor Coagulation: So that it is probable that this Substance, which is lock'd up in the forepart of the Eye, has nothing of Water but the Transparency and Fluidity, because that it has need of an extraordinary thinness and Subtility, to serve for the Refraction which must be made in the *Cryſtalline*, whose substance is thicker, by establishing the diversity of the Medium, which is necessary to this Operation.

The *Choroides* was brown, and the *Retina* white. The *Tapetum* was also of a blewish white. In the place of the Optick Nerve there was observed a black point. The Nerve entered into the Eye almost directly over the middle of the *Tapetum*. The *Cryſtalline* contained five Lines Diameter, and its Posterior part was not so Convex as the Anterior.

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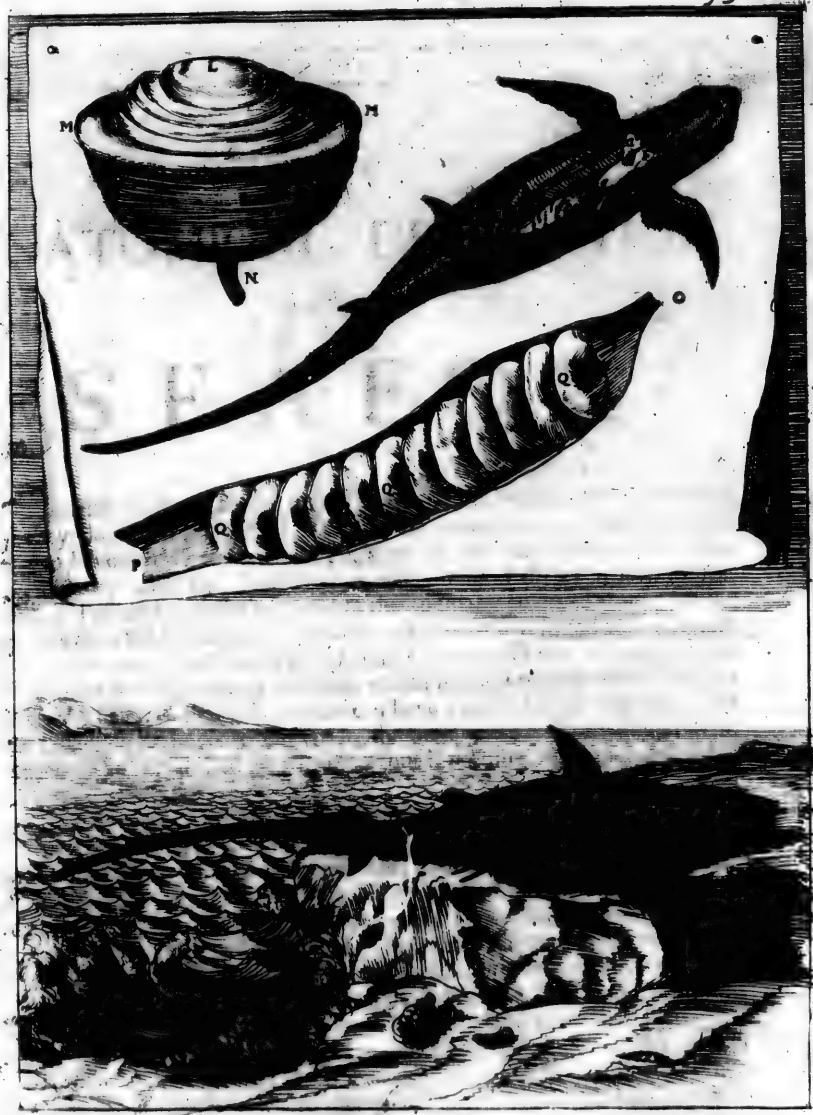
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The Explication of the Figure of the Sea-Fox.

IN the lower Figure it is laid in such a manner, that there may be seen the two Fins which it has on its Back, Eye, Nostril, and the five Apertures of the Gills, with the Teeth which are on the right side all of one single Bone, making only one row, and after another manner than on the left side, where they are separated from each other, and disposed in several rows, as is seen in the upper Figure.

In the Upper Figure.

- a. *Is the Heart.*
- B c. *The Right Lobe of the Liver.*
- c. *The Gall-Bladder, of which but a small part is seen, it being inclosed in the Liver.*
- D D. *The Left Lobe of the Liver.*
- e. *The Spleen.*
- F g. *The Ventricle.*
- g h. *The Duodenum.*
- h I. *The great Intestine.*
- j. *The Auricle of the Heart.*
- K. *The Aorta Ascendens.*
- L. *The Cornea sunk and folding over the CrySTALLINE.*
- M M. *The Edge of the Sclerotica.*
- N. *The Optick Nerve.*
- O P Q. *The great Intestine, part of whose coat is taken away to shew the Spiral Membrane that is within it.*
- O. *The part next the Duodenum.*
- P. *The beginning of the Rectum.*
- Q Q Q. *The Screw-like or Spiral Membrane.*



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THE
ANATOMICAL DESCRIPTION
OF A
SEA-FOX.

IN this Fish we found all the marks by which Authors describe that which they do call the *Sea-Fox*, except some particularities which are pretended to have made it so named. For they do say that it has a great deal of resemblance with the *Land-Fox*, as well in its Tail, as in its Subtily, Smell, and Taft of its Flesh: but none of the Company observed that it smelt otherwise than the Generality of Sea-fish. Its Flesh was found well tasted, to make it to be taken, (as it has been by some Authors,) for the *Accipenser*, or at least to make it unlike that of the *Fox*, which is known to be very ill; and it cannot be believed that this Animal can have a great deal of Subtily, if it be true that the Brain contributes to it, for there was hardly any found in it. As for the Tail it is indeed very strange, but it nothing resembles that of a *Fox*.

The *Sea-Fox* is by Authors put in the unflat Cartilaginous Cetaceous Kind, which are called *Galeodi*. Their generical differences, are to have two Livers, five *Bronchia* or Gills of each side, and pendent points at the Finns which are under the Belly, at the sides of the Navel in the Males. These Fishes are of six Species called *Cunicula*, *Acanias*, *Mustelus*, *Galexias*, *Asterias*, and *Alopias*, which is our *Sea-Fox*, whose Specifick difference, as to the Figure, is taken from its Tail, which very perfectly represents a Sythe.

The length of this whole Fish was eight foot and a half, and its greatest breadth directly over the Belly fourteen Inches. Its Figure was such, that from the end of the Nose to about the middle of its whole length, it had the common form of a Fish: for it grew larger toward the Belly, and then it did contract, to the place where the Tail of other Fishes end. But there it is that his began, which was almost as long as all the rest of the Body, and made like a *Sythe* bent towards the belly. At the place where this *Sythe* began, there was a single Fin underneath, which *Salvian* reports to be at the top, where

where there was only an Eminence, which was an Articulation that made the *Spine* to bend in this place higher and lower more easily than in all the rest of the Body, where the Flexion was easie only to the right and left.

There were two *Fins* elevated on the Back, a great one in the middle, and another less towards the Tail, altho *Aristotle*, according to the report of *Athenaeus*, says that it has not any Fin on the Back. It had three Fins on each side. The two next the Head were large, and representing the wings of a Bird, which is the reason perhaps that induced *Aristotle* to say that there is a Fox, which like *Bats*, hath leather wings. These Fins were fifteen Inches long, and five broad at their Basis. Those which were at the middle of the Belly were of a middle size. They were at the side of the Navel, and had each a pendent point: which is proper to the Males in this sort of Fish, as it has been said. The last near the Tail were very small.

The *Skin* was sleek and without Scales; the Crests and Fins were hard, and composed of small *Spines* restrained by the Skin which covered them, the Colour of which was all over alike of a very dark-gray, blewish like Mud, and not white at the Belly, as in *Salvian's* Fox.

The Opening of the *Mouth* was five Inches, and armed with two sorts of *Teeth*. The right side of the upper *Jaw*, to the place where are the *Canini* of other Animals, had a row of sharp *Teeth*, hard and firm, being all of one single bone in the form of a Saw; but this bone was much harder than the other bones which are fastened with a Cartilage in these sorts of Fishes. The other *Teeth*, which were on the side of this and all the lower *Jaw*, made six rows throughout, and were moveable and fastned by fleshy Membranes. Their *Figure* was Triangular somewhat sharp, and their *Substance* much softer than that of the others which are like a Saw, especially in the inward rows, where they were very brittle and softer than the Cartilage, so that there were some which appeared only like an hardened Membrane.

The *Tongue* was all firmly fixed to the lower *Jaw*, and composed of several Bones strongly articulated to each other by a fibrous Flesh. It was furnished with a hard *Skin*, and covered with little shining points, which made it very rough from the inside outwards, and very sleek and smooth from the outside inwards. These points viewed with a Microscope were transparent as Crystal, and appeared to have three Lines in length, and one and a half at their Basis.

The *Throat* was very large, and the *Oesophagus* was not lesser than the *Stomach*; in which Authors do say that this Fish conceals its young when they are afraid, by swallowing them down to vomit them up again; and this is the reason which made *Alian* and *Plutarch* to say, that the Subtily which this Fish has to quit it self of the Hook which it has swallowed, is to spew it up with its *Stomach*, which as *Alian* reports, it can turn the wrong side outward: which is much more probable than what others do say, viz. that it proceeds to swallow the Line untill it has found a place weak enough to cut it with its *Teeth*; because it has no *Incisores*.

This *Stomach* was about fifteen Inches long, and five broad, terminating at the bottom in a very Strait *Pylorus*, which was like a choaking, making the passage of the *Stomach* to the *Intestine*. This *Ductus* or passage, which exceeded not three Lines in length, and one and a half in Diameter, was very smooth

smooth and slippery, even as the *Oesophagus*, but the inside of the *Stomach* was rugged, and like to that of Animals which chew the Cud, which is called *Reticulum*. In the *Stomach* there was found a branch of the Sea-plant called in French *Purce*, about five inches long, and a Fish of the same length without a Head, Scales, Skin, and Entrails, being all digested, except the Muscular Flesh, which was left entire.

After the *Pylorus* the *Intestine* was a little enlarged even to contain four Lines Diameter, for the length of five Inches, which may be taken for the *Duodenum*, which was afterwards dilated for the forming a great Intestine, which was about eighteen inches long, and three broad. Its inferior part, which was smooth, and seven inches long, was the *Rectum*. The Superior which contained about thirteen Inches, had a very particular structure; for instead of the ordinary Circumvolutions of the Intestines, the Cavity of this was transversely interrupted with several separations composed of the Membranes of the Intestine folded inwards. These separations were near half an Inch distant from each other, and turned round like the shell of a Snail, or of a Stair-case with an open Newel: which is the reason, as it is easy to conjecture; why the nourishment stays, and is a great while in passing, altho the way be very short.

The *Liver* took up the whole length of the right side of the Belly. It was divided into two Lobes, which has made Authors to say that this Fish hath two Livers. The longest of these Lobes was twenty Inches, the other eighteen, each containing only five in breadth: its colour was reddish, and was streaked all along, and across by obscure Lines. The Gall was inclosed at the top of the great Lobe in the substance of the *Pancreas*, and was not gathered into a Vesicle; but its colour only seemed to appear green through the Tunicle of the Liver. The two Lobes weighed five pounds and a half. The Vesicle had in the inside as it were leaves composed of its Tunicle. The Gall which it contained was found to have more of Acidity than Bitterness.

The *Spleen* was fastened to the bottom of the *Stomach*. It was double like the *Liver*, and terminating in two unequal points, the longest of which was five inches. Its Colour resembled that of the *Liver*, being only somewhat less dark, and less brown. Near the *Spleen* there was observed a part fastened to the *Intestine*, which might be said to be the *Pancreas*, because that it was as it were Glandulous, but blacker than the *Spleen*.

Towards the *Navel* there was found a part shut up in the inside, about two inches long, and pointed at the end, which was judged to be the part which made the Sex, which was already discovered by the two points already mentioned, and which Authors report to be found only in the Males.

The *Bronchia* or *Gills*, which are five of each side, had this common amongst them that their Aperture, which is about two inches and a half, was enlarged almost as much again in the inside, to lap over a hole like to their Aperture: That wherein they differed, is that the three middle holes were greater, and provided on the inside with *Bronchie*. The two last which are somewhat lesser, especially that which is most distant from the Head, had this particular, that they were smooth, and without those Foliages whereof the *Bronchia* or *Gills* are composed.

The *Heart* had no *Pericardium*; but there was a Membrane like to that of the *Pericardium* which reinvested and enveloped the *Aorta*. The bigness of the *Heart* and its *Figure* resembled a *Pulley* Egg. Its *Ventricle* which was single as in most Animals which do not breathe, had five *valves*, three *Sigmoïdes* at the mouth of the *Aorta*, and two *Tricuspides* at that of the *Vena Cava*. The *Heart* had likewise one single *Auricle* very large, and the beginning of the *Aorta* was girt with a fleshy ring of ten Lines. The *Aorta Ascendens* having cast forth some branches for the *Brain*, was consumed, and near all lost under the *Tongue*.

The *Head* was a meer lump of *Flesh*, being covered with the *Muscles* of the *Temples*, which contained four Inches in thickness. The *Cranium* was not bigger than ones fist; it was near two fingers thick at top. This thickness was excavated by cavernous and unequal *Sinuses*. They were almost all empty, containing only a little mucous matter mixt with *Blood*. The *Brain* which was very small, and had but little Anfractuosity, was so soft and flabby, that no Observation could be made on its Structure.

The *Spinalis Medulla*, which shot out all along through the *Foramina* or holes which are between the *Vertebrae*, Filaments of *Nerves* about the bigness of a pin, produced at the beginning of its Exit out of the *Cranium*, three Pairs which were about a line and a half in bigness, two whereof divided themselves at the *Temporal Muscles*, and at those which do move the great fore-Fins; the third Pair run all along the *Back-bone*, always keeping the same bigness, although it continually cast into the *Flesh* little branches like those which proceed from the *Medulla Spinalis*.

The *Eyes* which were larger than those of an *Ox* were only demi-spherical, being flat before, and the *Sclerotica* making as it were a Cup. This Membrane was very thin, but so hard that it might rather pass for a Bone than a Membrane. On the contrary, the *Cornea* was so tender, that it was folded and sunk on the *CrySTALLINUS*, which was perfectly Spherical, as it is generally found in *Fishes*; yet in one of the *Eyes* it was somewhat flattened.

The Anterior *Uvea* was not black, nor very obscure in the inside, but only greyish, as it is on the outside, where it makes the *Iris*. The *Choroides* was of the same colour, and its ground had that lustre of Mother of Pearl which is in *Terrestrial* Animals, and which we do call the *Tapetum*, but with colours less brisk. The *Retina* was adorned with Sanguinary Vessels very apparent.

This *Fish* was very *Fleshy*, and in several places we found *Fat* above an inch thick; which very much Fortifies the Opinion of *Archestratus*, who in *Athenaeus* avers that the *Sea-Fox* is that *Fish* which those of *Syracuse* do call *Cyna Pina*, by reason of the abundance of *Fat* which it hath? which is contrary to the Opinion of *Epanetus*, who says in the same Author, that Cartilaginous *Fishes* have none.

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The Disposition of the Fibres of the Brain

THAT which is in the Brain is divided into three parts, the first of which is the Head, the second is the Neck, and the third is the Back. The Head is divided into the Brain, the Eyes, the Ears, the Nose, and the Mouth. The Neck is divided into the Throat, the Trachea, and the Larynx. The Back is divided into the Spine, the Ribs, and the Pelvis.

The Disposition of the Fibres of the Brain

- A. The one of the Kidneys which is the right.
- B. C. The Tongue.
- D. D. The Intestines of the small.
- E. E. The Liver.
- F. F. The Gall-bladder.
- G. G. The Ventricle.
- H. H. The Spleen.
- I. I. I. The Nerves which are called the 7 nerves.
- K. K. K. The Epiglottis.
- L. L. L. The Intestines.

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The Explication of the Figure of the Lupus Cervarius or Lynx.

THAT which is most Considerable in the lower Figure is the black Hair, which makes the Tuft that each Ear has at the tip, and the roundness of the Head as well as the rest of the shape of the Animal which nothing participates of that of the *Wolfe*.

In the Upper Figure.

- A. *Is one of the Kidneys as big as the Life.*
- B C. *The Tongue.*
- D D. *The Integuments of the lower Belly.*
- E E. *The Liver.*
- F. *The Gall-Bladder.*
- G. *The Ventricle.*
- H. *The Spleen.*
- I. I. I. *The Vessels making that, called the Vas-breve.*
- K. K. K. *The Epiploon.*
- L. L. L. *The Intestines.*

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THE
ANATOMICAL DESCRIPTION
OF A
LUPUS CERVARIUS
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Some Authors have thought that this Animal was called *Lupus Cervarius*, from its Figure and Colour, supposing that it has the Shape of a *Wolfe*, even as it in some measure resembles the *Stagg* in the Colour of its Hair. This very Reason hath made others to think that it is the *Thos* of the Ancients, because *Oppian* reports that the *Thos* has the Form of its *Sire* which is the *Wolfe*, and Colour of its *Damme* which is the *Leopardess*. But the truth is that the *Lupus Cervarius* or *Lynx* has nothing which resembles the *Wolfe*; and the little resemblance which it takes from the *Leopard* or *Stagg* is so common to a great many other Animals, that it is more probable, as several Believe, that the Name of *Lupus Cervarius* is given unto it, because that it hunts *Staggs*, as the *Wolfe* devours *Sheep*.

That which was Dissected had not the Nose long and pointed like the *Wolfe*, but blunt and short, which made it rather to resemble a *Car*. The length of the whole Head was seven Inches, that of the Neck four: The rest of the Body contained twenty four Inches, without comprehending the Tail which had but eight; the whole amounting to three Foot seven Inches. The height from the extremitie of the Back to the end of the fore-paws were twenty Inches, and there were twenty three from the *Os Sacrum* to the extremities of the hind-Feet.

The fore-Paws had five Toes; the hind-ones only four. All these Toes were armed with Claws crooked, pointed, and articulated as in the *Lions*, *Bears*, *Tigers* and *Catts* which we have Dissected.

The Back was of a *Fox-red*, marked with Black Spots. The Belly and in-

inside of the Leggs was of an Ash-colour, speckled also with Black Spots, but differently; for the Spots of the Belly were larger, not so Black, nor so close to each other as those of the Back, Leggs and Paws, whose outside was red like the Back. The greatest part of the Hair, *viz.* that which appeared red, and that which appeared of an Ash-colour, was indeed of three Colours, having the root of a Dark-Gray, and the extremity White: But this Whiteness of the extremity took up so little a portion of the Hair, that it prevented not the seeing its principal Colour, which was that of the middle, and it made the whole Superficies of the Body to appear only as if it were powdered. The Hair, which made the Black Spots, was but of two Colours, having no White at the end, and being only less Black towards the root, which nevertheless was Browner than that of the other Hair.

The *Dentes Canini*, which were four, were eight Lines long in the upper-Jaw; the two of the lower-Jaw but six. Between the *Canini* there were in each Jaw six *Incisores*, and those of the upper were likewise longer than those of the lower. There were ten *Molares*, five in each side, *viz.* two above, and three below in each Jaw.

The *Tongue* was four Inches and a half long, and an Inch and a half broad. It was covered with Pricks as in the *Lion* and *Catt*. These Points from the tip of the Tongue to the middle were very hard and sharp, and were turned towards the root of the Tongue. Those which were from the root to the middle were turned contrary; and were blunter and softer.

The *Ears*, which greatly resembled those of a *Catt*, had each on the tip which was pointed, a Tuft of very Black Hair, which seemed to us to be a Character very particular to the *Lupus Cervarius*, to distinguish it from several other Animals which are described in the Histories of the Antients, as the *Thos*, *Chaos*, and *Panther*; which modern Authors have taken for the *Lupus Cervarius*; but in none of which has there been observed this Tuft, which *Adrian* reports to be at the end of the Ears of the *Lynx*, after the same manner as we found it in our Subject, and in other *Lupi Cervarii* which are in the Park of Vincennes.

It is very hard to conjecture why modern Authors have taken the *Lupus Cervarius* for the *Thos* of the Ancients, of which some, as *Theocritus*, have only reported it to be a kind of *Wolfe*; and others, as *Homer*, that it Eats *Stags*: For it is pretended that this Author has in some measure described the Nature of the *Thos*, by comparing them to a multitude of *Trojans*, which pressing *Ulysses* in a Combate are put to Flight by *Ajax*, who comes to rescue them: But by this Comparison he gives us to understand that the *Thos* are weak, and Cowardly Animals, seeing that being assembled to eat a *Stagg* which has been wounded by a Hunts-man, they do leave it to a *Lion* which unexpectedly comes upon them. For this reason they are by the *Scholiast* interpreted *Pantheria*, which are a kind of weak and timorous *Wolfe*. *Aristotle* and *Theocritus* do likewise say, that the *Thos* resembles the *Wolfe*, that he is swift-footed, and leaps a great way, although he has short Leggs.

But there are other reasons to make us believe that the *Lupus Cervarius* is not the *Thos*, which are much more powerful. For besides our not finding our *Lupus Cervarius* to have short Leggs, the other Marks also which the Antients do attribute to the *Thos* are wanting in it, having not the

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the Figure of the *Wolfe*, as *Aristotle* and *Oppian* describe it, not being weak and timorous, as *Homer* represents it, not having another Colour in the Winter than in the Summer, nor being of the kind of Animals which do love Man, which do him no harm, and which do not avoid him: For it is known that these Characters, by which *Aristotle* and *Pliny* do represent the *Thos*, are not found in the *Lupus Cervarius*; and the greatest part are contrary to what we have observed in that which we Dissected.

There was only the changing of the Hair which we at first thought to be so as *Aristotle* represents it in the *Thos*; because that the Hair of the *Lupus Cervarius*, which was brought to us towards the end of Autumne, was very different from the Hair of those we had seen in the Summer in the Park of Vincennes; these last having not their Backs Red, nor spotted with Black like ours, but only confusedly intermixt with Black, Gray, and Red: Besides that their Hair was short, thick, and coarse as in a *Mastive*, whereas our *Lupus Cervarius* had it long, soft, and fine like that of a *Catt*. But we at last found that this diversity in the Colour of Hair proceeded not from the alteration which happens to it according to the Seasons, but from the difference of the Species of the *Lupi Cervarii*: For there are some whose Back is Red, spotted with Black, which do come from *Muscovia*, such as was ours; and others which do come from the *Levant* and *Canada*, which have no Spots on the Back, such as are those which we have seen at Vincennes.

Therefore Authors do differ amongst themselves, and there are some which do even contradict themselves on this Opinion that the *Thos* is the *Lupus Cervarius*. For though *Scaliger* and *Gaza* do always interpret the *Thos* in *Aristotle*, *Lupus Cervarius*, which *Gesner* and *Gillius* do likewise in *Ælian*; yet *Scaliger* when he speaks of the *Lupus Cervarius*, says that he thinks it is the Male *Lynx*, which may make us to think that he takes the *Thos*, *Lynx*, and *Lupus Cervarius* for the same Animal, conformable to the Explication of *Petrus Crinitus*, who interprets *Thos* in *Homer* *Lynxes*, and to that of *Eustathius*, who says that the *Thos* is no weak and timorous Animal, because that he judges the *Thos* to be the *Lupus Cervarius*, which indeed is strong and courageous.

But *Hermolans* on *Pliny*, says that he cannot sufficiently wonder at the error of those who do take the *Lupus Cervarius* for the *Thos*: For the Species of the *Wolfe*, which is pretended to be the *Thos*, is a weak and timid Animal, which is by *Gesner*, *Gaza*, and *Niphus* called *Lupus Canarius*, *Lupus Armenicus*, and by the Scholiast of *Homer* *Panther*; and *Oppian* puts the *Thos* among the little and inconsiderable Beasts, such as are *Dormice*, *Squirrels*, and *Catts*; which is confirmed by *Hesychius*, and seems to be very suitable to the Idea which *Homer* gives of the *Thos*.

So that it remains only to see whether our *Lupus Cervarius*, which has so little relation with the descriptions which the Antients do make of the *Thos* and *Panther*, has any more with what they have Writt of the *Chaos* and *Lynx*. *Hermolans* makes no question that it is the *Chaos* of *Pliny*. And indeed, when this Author speaks of the *Lupus Cervarius*, he reports the same thing thereof as he said of the *Chaos*, which is that *Pompey* shewed some in his Theater at Rome, which were spotted like the *Leopard*, and which had been sent from the *Gauls*, that is to say, a Northern Country, where the *Lupi Cervarii*, which have Hair like that of the *Leopard* are found in great plenty.

But

But the difficulty lies in what *Pliny* says that they had the Shape of the *Wolfe*; which we found not, as has been said, in our *Lupus Cervarius*. In-
somuch that there remains only the *Lynx*, of which the Ancients do say no-
thing which is repugnant to what we have seen in our *Lupus Cervarius*, in
which we have likewise found all that they report of the *Lynx*.

For besides the lock of Black Hair which *Ælian* Remarks on the tip of the
Ears of the *Lynx*, and which we have observed to be after the same manner
in our Subject, which is a very particular Mark, we have likewise found
that it has a short Nose like *Ælian's Lynx*, and it is known that the *Lupus
Cervarius* is very cruelly bent after the hunting of *Staggs*, which *Oppian*
Reports to be peculiar to the great *Lynx*; of which he makes a Species
different from the little one which Hunts *Hares*. For as to the Blackish
Colour which *Pliny* gives to the Hair of the *Æthiopian Lynx*, he mentions it
as a thing extraordinary. And in short as for what concerns its sight, which
Pliny Reports to be more piercing than in any other Animals, we have Re-
markt nothing which may obstruct, or hinder us from believing our *Lupus
Cervarius* to have had a very piercing Sight; besides it is not very certain
whether that which is reported of the sight of the *Lynx* must be understood
of that of a wild Beast, or of a Man of that Name, who had a Sight so good,
as *Pliny* affirm's, that he saw the Moon when it changed; or of an other, who,
as *Georgius Agricola* explains it, had the repute of seeing thro' the Earth, be-
cause that he knew how to discover where the most concealed Metals were.

As for what concerns the Inwards of our *Lupus Cervarius*, which was a
Female, we found that it had a Stomach like to that of *Cats*, having nothing
extraordinary either in its Structure or Bigness, which was proportionable
to that of the rest of the Body.

The *Spleen* which was laid along the left part of the Stomach was of a Red-
dish Colour. Its Length was seven Inches, and its Breadth but one. All a-
long one of its sides, *viz.* that which was towards the Stomach, it had an
Eminence which made an Angle.

The *Epiploon*, which covered and inclosed the Intestines, was like a Net-
work of Cords of hard and solid Fat, whose void spaces were filled with
Membranes pierced with an infinite number of little holes, so that as these
Membranes were not capable of retaining Water like those of the *Epiploon*
of Men and several other Animals. These Ropes of Fat did inclose and co-
ver almost all the Vessels of the *Epiploon*.

The *Intestines*, which were of an equal bigness, contained altogether nine
Foot and a half in length: which seem's to have been observed by *Pliny*, who
speaking of Animals which have short *Intestines*, produces only two exam-
ples, which are the *Lupus Cervarius* and *Duker*. Yet we have already Re-
markt in the *Lyons* that we Dissected, that their *Intestines* were not above
three times longer than the whole Body, which is the proportion of the *In-
testines* of the *Lupus Cervarius*. There was a *Cæcum*, but it had no *Appendix*.

The *Liver* had seven Lobes, which were long and straight. The longest
was five Inches, and the broadest two: and a half towards the Basis. The
Gall-bladder contained nine Inches in length, and not exceeding half a one in
breadth.

The *Pancreas Asellianum* was three Inches long, and fifteen Lines in its
greatest breadth. It had a Cavity full of slimie and putrified Serositie, which
was the occasion of an Abscess in the Center of the *Mesentery*. The

The *Kidneys* were situated at an equal height opposite each to other. They were two Inches in length, and one in breadth.

The *Matrix* resembled that of *Bitches* and *Cats*. It contained four Inches and a half from the external *Orifice* to the Bifurcation of the two *Hornes* or *Ductus's*, which from the Bifurcation to their *Extremities* where the *Testicles* were, contained each four Inches and a half in length. The *Testicles* were six lines long, and four broad: They were composed of several *Glands*.

The *Lungs* had seven *Lobes* like the *Liver*. They were almost all dried up and friable through the extraordinary heat of the *Blood*, which was Black by adustion. This Blackness of the *Blood* had made the *Heart* livid, and tinged the *Water* of the *Pericardium*, so that it was Bloodie. The *Heart* was two Inches and a half long, and two Inches broad. The *Auricles*, *Vessels* and *Valves* were as in a *Cat*.

The *Muscles* of the *Temples* were large and strong, being eight Lines in thickness, and two Inches in breadth. This bigness seemed to us very considerable, to make dubious the belief which we had that the *Lupus Cervarius* is the *Lynx* of the *Antients*; because that when *Galen* speaks of the different size of the *Muscles* of the *Temples* in various *Animals*, he gives only three examples of those which have them extraordinary small and feeble, which are *Man*, the *Ape*, and *Lynx*. But it is probable that *Galen* means the little *Lynx* of *Oppian*, which only hunts *Hares*, and not that which devours *Staggs*, which is the *Lupus Cervarius*.

The *Sinus's* of the *Skull* were very ample and open. The *Bone* which separates the *Brain* from the *Cerebellum* was like to that which we have found in a *Tiger*, *Fox*, *Dog*, *Cat*, and a great many other *Animals*.

At the opening of the *Skull* the *Anfractuosities* of the *Brain* appeared thro' the *Dura Mater*, which was transparent. The external part and Substance of the *Brain*, which is called the *Cortex*, was very white and solid. The *Glandula Pinealis* was very small.

The *Ball* of the *Eye* was an Inch Diameter: It was almost Spherical, except the *Cornea*, which was raised somewhat more pointing.

The thickness of the *Cornea*, which was half a Line, was every where alike. It was joyned as usually with the *Sclerotica* by the mutual Attenuation of the extremities of the two *Membranes*, which being each in this place made like the *Diamond-cut* of a *Glass*, do so joyn themselves that both together are not thicker than each apart, because that the thinnest place of the *one*, which is its extremity, lyes upon the thickest place of the other.

These Slopeings were each two thirds of a Line broad. The *Sclerotica*, which was outwardly White, and inwardly somewhat Blackish by the touching of the *Uvea*, was very thin at the bottom, not being thicker than strong Paper. It was twice as thick at its extremity towards the *Cornea*.

At the side of the *Cornea* there was a Membrane as in the *Lyon*, which serves for an internal *Eye-lid* which easily covered all the *Pupilla* when it was thrust over it. It was of a triangular Form. The two lesser sides were fastened to the *Conjunctiva*. The third, which was the largest, could slip and advance over the *Eye* to cover it.

The fore-part of the *Iris* was of a Yellow-colour mixt with a great many little red Lines, which were broken and of an unequal size. It was Black at the hinder part which lay upon the *CrySTALLINE*.

The

The *Aqueous Humour* was very abundant, but somewhat muddie, being
 fullied by the dissolution of some part of the Black Substance, which is fasten-
 ed to the *Uvea*.

The *Crystalline* was seven Lines diametery, and five thick, three of which
 made the *Anterior Camerula*, and two the *Posterior*.

The *Vitreous Humour* was very Clear and Transparent.

The *Tapetum* of the *Uvea*, which was of a Blewish White, was pierced
 by the *Optick Nerve*, not at its extremitie, as it is seen in most Animals, but
 almost in its Center. The *Optick Nerve* had in its middle a Red point, incline-
 ing to Black.

The *Optick Nerve* was of a soft and spongy Consistence, and was
 fastened to the *Brain* by a small Artery, and a Vein, which were
 accompanied by a small Lymphatick Vessel.

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 accompanied by a small Lymphatick Vessel.

The Explanation of the Figure of the Case of the

It is represented below, with half of the Body that is the fore part on the
Land, and hind part in the Water; because that it was observed dur-
ing the time that it was kept, that it bowed towards the Water, and
saw and fell into the Water.

In the Upper Figure

- A. The Indian.
- B. The Boat.
- C. The Body of the Boat, which are the wings of the Boat, where the Case is.
- D. The second part, which is the fore part.
- E. The fore part, which is the fore part.
- F. The second part, which is the fore part.
- G. The fore part, which is the fore part.
- H. The fore part, which is the fore part.
- I. The fore part, which is the fore part.
- K. The fore part, which is the fore part.
- L. The fore part, which is the fore part.
- M. The fore part, which is the fore part.
- N. One of the fore part.
- O. The fore part.
- P. The fore part.
- Q. A Lignum, which is the fore part.
- R. The fore part.
- S. The fore part.
- T. The fore part.
- V. The fore part.
- X. The fore part.

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The Explication of the Figure of the Castor or Beaver

IT is represented below, with half of the Body, that is the fore part, on the Land, and hind part in the Water; because that it was observed during the time that it was kept, that it loved frequently to plunge its hind-Paws and Tail into the Water.

In the Upper Figure.

- A A. *The Os Pubis.*
- B. *The bottom of the Bladder.*
- C C. *The two first Pouches, which are the largest of those, wherein the Castoreum is prepared and contained.*
- D D. *The two second, which are less.*
- E E. *The other Pouches of a third sort, inclosed in the second.*
- D E. *Several little globular Body's seen upon the second and third sort of Pouches.*
- F. *The Common Hole to the Intestine and Penis.*
- G. *The beginning of the Penis.*
- H H. *The Epididymides.*
- I. *The Testicles.*
- K K. *The Vasa Spermatia Præparantia.*
- L L. *The Deferentia.*
- M M. *The Cremaster's.*
- N. *One of the fore-Paws.*
- O O. *The Colon.*
- P. *The Cæcum.*
- Q. *A Ligament fasten'd to the Cæcum; along which are spread several Vessels which loose themselves in the Coat of this Intestine.*
- R R. *The Brain.*
- S. *The Sinus of the Dura Mater.*
- T T T T. *Four other Sinus's proceeding from the other, which divide the Cerebellum in three.*
- V V V. *The Cerebellum.*
- X. *The bone of the Penis.*

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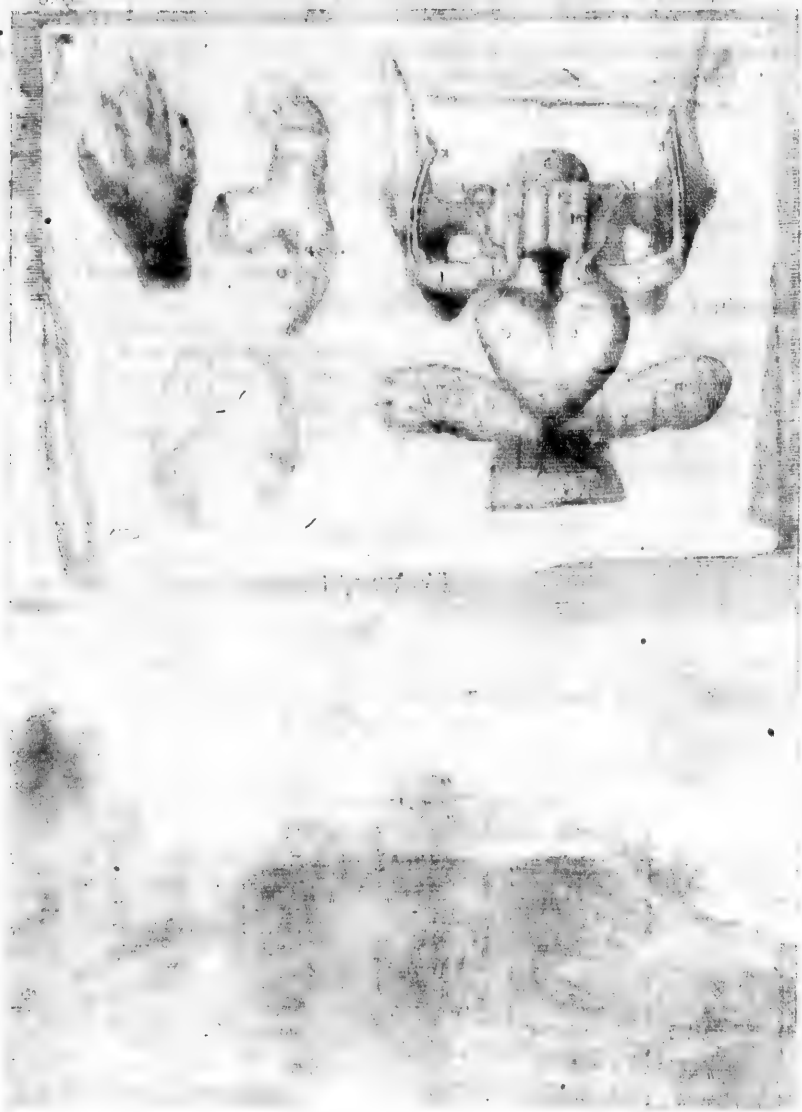
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THE
ANATOMICAL DESCRIPTION
OF A
CASTOR
OR
BEAVER.

IT was so much the more necessary to observe nicely all the Parts of the *Castor*, because there has not hitherto been made an exact Description thereof; the Ancients having been almost wholly silent concerning this Animal, and the Moderns applying themselves more to speak of its Nature, than to examine the Structure of its Body.

That which was dissected at the King's Library was taken in *Canada*, about the River of *St. Lawrence*. It resembled an *Otter*, but was larger and bigger, and weighed above Thirty Pounds. Its length was about three Foot and a half, from the end of the Nose to the tip of the Tail, and its greatest breadth was near twelve Inches.

The *Hair* which covered its whole Body, except the Tail, was not every where alike; but there were two sorts, which were mingled together, and which differed in length as well as Colour. The bigger was about an Inch and half long, and as thick as the Hair of ones Head. Its Colour was Brown, somewhat inclining to a Minime or Soot-colour, but very bright; and its substance was firm, and so solid, that having cut it crosswise there could not any Cavity be seen, even with the Microscope. The lesser was about an Inch in length; there was some much shorter than others; it seemed likewise more slender, and was so soft, that the finest down is not softer. The mixture of these two sorts of Hair so different is found in many Animals; but it is most remarkable in the *Castor*, *Otter*, and *Wild-boar*; and it seems that it is likewise more necessary for them: For these

Animals being subject to wallow in the Mire, besides the short Hair which Nature has given them to defend them from the Cold, they had need of another longer Hair to receive the Mudd, and keep it from penetrating to the Skin.

Its Head was five Inches and a half long, from the end of the Nose, to the hinder-part of the Occiput, and five Inches broad at the place of the Bones which do make the Eminency of the Cheeks. This Proportion has made the *Castor*, to be by *Herodotus*, put amongst the Animals which he calls *Tetraprosopa*, that is to say, with a square Face or Head. Its Ears resembled those of an *Otter*; they were round and very short, covered with Hair on the out-side, and almost without any within.

It is said that this Animal delights to know Trees, and that it cuts them down to make its Dams or Hole withal; and indeed its Teeth were made after a manner very proper for it. At the end of the Nose it had four *Incisores*, two in each Jaw, like *Squirrels*, *Rats*, and other Animals which love to nibble. The lower ones were above an Inch long, but the upper were not above ten Lines, and slipped within the others, not being directly opposite to them. As to their shape, they were half round before, and very sharp at the end, which was cut bevelling on the in-side and out-side. Their Colour was White on the in-side, and on the outside of a brisk Red inclining to Yellow, almost like that of bastard Saffron. They were both about two Lines broad at the going out of the Jaw, and above a Line at their extremity. Besides these *Incisores*, there were sixteen *Molares*, that is to say, eight in each side, four below, and four above. They were directly opposite one to another, and had nothing particular.

As to the Eyes we could not examine them, because that the *Rats*, or some such Creatures had eat them.

The Structure of the Feet was very extraordinary, and sufficiently demonstrated, that Nature hath designed this Animal to live in the Water as well as upon Land. For altho' it had four Feet, like terrestrial Animals, yet the hindmost seemed more proper to swim than walk with, the five Toes of which they were composed being joyned together like those of a *Goose*, by a Membrane which serves this Animal to Swim with. But the fore-ones were made otherwife; for there was no Membrane which held these Toes joyn'd together; and this was requisite for the conveniency of this Animal, which uses them as Hands (like *Squirrels*) when he eats. The Proportion of these Toes, their Situation, and the Shape of the Palm, do make these Paws wholly like Hands; and when *Mastolius* says that they do differ from the Hands of an *Ape*, he evidently demonstrates that he has confounded the *Castor* with the *Otter*, which has the Toes of the fore-feet provided with Skins like those behind; which perhaps he has inferr'd from what *Pliny* says, that the *Castor* is altogether like the *Otter*, except the Tail. The length of the fore-feet was six Inches and a half from the *Cubitus* to the end of the great Toe; and three Inches from the beginning of the Hand to the extremity of the greatest Finger: those behind were longer, and contained six Inches from the extremity of the Heel to the end of the longest, which was the second Toe. Besides these five Toes, which were all furnished at the end with Nails cut aslope, and hollow in the inside like Pens, there was in the external Part of each fore and hind-foot, a little Bone which made an eminency, and which might have been taken for a sixth Toe, had it been separate and divided

divided from the Foot; but as it was not, it seemed that it served only to add more strength and firmness to the Foot.

The Tail is that which has principally made the Castor to be reckoned in the number of the *Amphibious*: For it has not any resemblance with the rest of the Body, and seems to partake more of the Nature of *Fish* than of *Terrestrial* Animals. It was covered with an *Epidermis* composed of Scales, which a Pellicle joyned together. These Scales were about the thickness of Parchment, about a Line and half in length, and for the most part of an irregular Hexagonal Figure. Those on the upper part of the Tail were very little different from those underneath; save that amongst some of the under ones there grew sometimes one, sometimes two, and sometimes three small Hairs, which were bent downwards, and exceeded not two Lines in length. As to the Colour they were of a Dark-gray inclining to a Slate-colour; but in the joints the *Epidermis* appeared of a Darker Colour. When the Skin of the Castor was dead, the Scales of the Tail fell off, but their Figure remained imprinted thereon; and this part of the Skin, where the Scales were, became White, and of a Substance like that of the Skin of *Fish* as the *Purpoise*, or *Sea-Fox*. In dissecting the Tail we also found that the Flesh thereof was very Fat, and had a great deal of resemblance with that of *Cetaceous Fishes*.

As to the rest, the bulk and shape of the Tail was very remarkable. It was about eleven Inches in length, and at the root it exceeded not four Inches in breadth. From thence it went insensibly increasing on each side to its middle, where it was five Inches; and afterwards it lessened to the end, where it terminated in an Oval. On the contrary it was thicker towards its root than in all the rest of its length: For in this place it was near two Inches thick, and decreased by little and little towards the other end; so that in its middle it exceeded not an Inch in thickness, and was reduced to five Lines and a half at its extremitie. The edges of its Circumference were round and somewhat thick, altho' they were much thinner than the middle.

The Hole through which this Animal casts its Excrements was situated between the Tail and *Os pubis*, about two Inches higher than the beginning of the Tail, and three Inches and half lower than these Bones. It was of an Oval Figure, about nine Lines in length and seven in breadth. The Skin about it was Black and without Hair, and was easily contracted and dilated, not by a *Sphincter* as the *Anus* of other Animals, but simply like a slit. This hole was common to the passage of the Urine as well as to that of other Excrements: For besides that the *Anus* or extremitie of the *Rectum* ended therein, a little lower, in the Anterior Part, there was seen to appear the extremitie of this Animals *Penis*.

At the sides of the inside of this common passage we observed two small *Cavities*, one in each side, where we endeavoured to introduce a *Stylus*; but we could not make it to pass from the inside of the Hole towards the out; and thro' the outmost Skin we perceived two Eminencies, which we afterwards found to be the Baggs or Bladders which do contain the *Castoreum*: And it being that which is most remarkable in this Animal, we examined it with a particular exactness.

Naturalists have spoken variously thereof. Some do Assert that the *Castoreum*

remains

reum is lockt up in the *Testicles* of the *Castor*; and *Ælian* says that this Animal knowing that Men do hunt it only to get this Liquor of so great use in Physick, tears off its *Testicles* when it sees it self closely pursued by the Hunters, and leaves them to them as for its ransom. Others are of Opinion that the *Castoreum* is not found in the *Testicles* of the *Castor*, but in the Bags particularly designed to receive this Liquor.

To inform us of the Truth, we stript our *Beaver* of its skin; and having taken it away, we discovered in the place where we had observed these Eminencies, four great Pouches fixed underneath the *Os Pubis*. The two first were placed in the middle, and higher than the two other. They both together represented a kind of Heart, the top of which was about an Inch under the *Os Pubis*; and the sides, being circularly extended, did approach to re-unite themselves in the upper part of the common aperture. The greatest breadth of these two Pouches taken together, was a little more than two Inches; and the length from the top of each to the common aperture was likewise about two Inches. They appeared externally of an Ash-colour, streaked with several white Lines of the shape of those which are seen in the *Saligor* or *Water-mut*. Their outward Coat was without wrinkle or fold, and appeared clear and transparent, so that its Colour seemed to be borrowed of the Coat which was underneath. And indeed, having opened one of these Pouches, we found that the inward Coat was of an Ash-colour; that moreover it was fleshy, and that it had on the inside several wrinkles like to those of a Sheeps Maw, amongst which we found some remains of a greyish matter, which had a stinking smell, and which was there so strongly fastened that it seemed to be a part thereof. These wrinkles were extended into both these Pouches, which had communication one with the other, by a hole of above an inch, and were separated only at the bottom.

Underneath these first Pouches there were two others, one at the right, and the other at the left side; each of which had the Figure of a *Pear* somewhat flatted, or of a long green *Almond*. They were each two inches and a half in length, and ten lines in breadth. Their greatest breadth was towards the end farthest from the common Passage of the Excrements, and ended at the sides of this hole. These two Pouches were so placed, as that they jointly formed with the said common hole the shape of a very open V, from the inside of which the two first Pouches raised themselves like a Heart, as we have already said.

These two lower Pouches were very streightly joyned with the upper, about the common hole; and it is probable that the matter of the *Castoreum* having begun to be prepared in the two upper Pouches, passeth into the other two there to be perfected, and to acquire more consistence, more oiliness, more smell, and a yellower colour, which appeared very little in the upper Pouches. The structure also of these Pouches were very different. It seemed that the lower ones were composed of Glands, like the Kidneys of young Animals: for in their exterior surface there was a great number of small round Bodies, a little rising, and of a different size, the largest not exceeding a middleing Lentile. They were all covered over with the Membrane which externally enveloped all the great Pouches, which is nothing else but a Continuation of the common Membrane of the Muscles.

Having

Having opened several of these little Glandulous Bodies, we found that they were composed of a spongie Flesh of a whitish colour inclining to a red, and that they all had a considerable Cavity: so that it seemed as if they were so many little Pouches; but there was no Liquor in them, nor any other remarkable Substance.

We, judging by the Touch that there was some Liquor in the Pouches, of whose surface these little Bodies made a part, opened one at the bottom, keeping that of the other side to save the Liquor. Out of this hole there came a stinking Liquor, yellow as Honey, unctuous as melted Fat, and combustible as *Turpentine*; for it took fire being put to the flame of a wax-candle. We would have seen whether by squeezing there would not be a reflux of this humour into the upper Pouches, or into the common passage of the Excrements; but neither the one nor the other fell out.

Having afterwards emptied the Liquor of this second Bag we perceived that in its lower part there was a third Pouch about fourteen lines in length, and six in breadth, which was likewise full of Liquor, and so fastened to the Membrane of the second Pouch, that it could not be separated. It went sloping to a point on the lateral part of the common hole; but we perceived not that there was any passage into the Cavities which we have spoken of in describing this hole; for we could make nothing go out that way. In the external surface of the third Pouch there were little glandulous Bodies like those which we observed in the second. In this third Pouch we found a Juice, yellower, more liquid, and better digested than in the others. It had also a different smell, and greatly resembled the yolk of an Egg, but its colour was somewhat paler.

Tho it was proposed in this discourse to speak only of the Observations made in the Dissection of the *Castor*, it will be no digression to relate what has been since written from *Canada* touching the *Castoreum*. It is reported that the *Castors* do use this Liquor to create themselves an Appetite when they have no Stomach; that they do get it out by squeezing with their Paw the *Vesicles* which do contain it; and that the *Savages* do therewith rub the Snares which they lay for these Animals on purpose to entrap them. *Rondeletius* had well observed that the *Castors* do frequently lick up this Liquor; but he speaks not of the particular uses which are told us that the Animal and Savages make thereof.

But to return to the Pouches which contain the *Castoreum*, it is evident by the accurate Description which we have already made thereof, that they are not the Testicles of the *Castor*, as several Naturalists have imagined, whose Error will likewise more evidently appear, by what we shall afterwards speak of these Testicles.

Sextius, according to the relation of *Pliny*, derided those who believed that the *Castor* tears off his Testicles, when closely pursued by the Hunters, and said that it was impossible, because that this Animal hath the Testicles fastened to the Back-bone. But he confutes one error by another. For as *Dioscorides* has very well observed, the Testicles of the *Castor* are concealed in the Groins, and not fastened to the Back-bone. Nevertheless *Amarus Lufitanus* and *Mathiolus*, who have both Commented upon *Dioscorides*, and who say that they have Dissected *Castors* in the presence of several Physicians, do

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averr that they have found these Testicles so fastened to the Back-bone, that they had great difficulty to separate them with a Launcet. *Rondeletius* runs into the same error, altho he has examined a little better than other Authors the Pouches from which the *Castoreum* is taken; but yet very negligently, not to perceive that they are four in number; for he reckons but two. There are some more Modern Authors who have not gone much farther than the other, contenting themselves with knowing that the Testicles are different from these Pouches; and have so ill understood *Dioscorides*; as to believe that when he says the Testicles of the *Castor* are hid in the Groins, he took the Pouches for them. But experience hath demonstrated to us that all these Authors are mistaken, if all *Castors* are like to that which we Dissected: for the Testicles were no more on the inside than the Pouches; they were only a little higher at the external and lateral parts of the *Os pubis*, in the place of the Groins, where we found them wholly concealed, so that they appeared not outwardly no more than the *Penis* before that the skin was taken off. Their Figure and Shape was very like to the Stones of *Dogs*, save that they were longer and lesser in proportion to their length. They were little more than an inch long; their breadth was half an inch, and their thickness somewhat less. As to the *Epididymis* and all the Vessels necessary to Generation, they differed in nothing from those of *Dogs*.

The *Penis* appeared more singular to us. In its extremity instead of the *Balanus* it had a Bone fourteen lines long, and made like a *Spyler*, which was two lines broad in its basis, and suddenly straitning it self, ended in a point. There was this also remarkable, that whereas the *Penis* of *Dogs* re-ascends from the *Os pubis* towards the *Navel*, this descended downwards towards the passage of the Excrements, where it ended. It was, as we have said, concealed; so that before the skin was taken off we perceived it not, and we could not discern of what Sex this Animal was.

The better to examine these Parts, we opened the lower *Venter*; and having traced the *Spermatick* Vessels to their *Origine*, we found them like to those of *Dogs*, and other Animals. We observed likewise that the *Penis* was laid upon the *Rectum*; and that it passed underneath the two first Pouches of the *Castoreum*, to which it was closely joyned: that moreover these Baggs received their Veins and Arteries from the *Hypogastrick* Veins and Arteries, there being no appearance that there were other Vessels which could furnish the matter whereof the *Castoreum* is formed, unless it be imagined that it is caused by the *Uret*, which is improbable.

As to the other parts of the lower *Venter* the Muscles of the *Abdomen*, *Peritonaeum*, *Stomach*, and *Bladder*, had nothing remarkable, and their Structure was altogether like that of *Dogs*.

The *Intestines* had little considerable, except the *Cacum*, which was two inches and a half in breadth, and ten in length. It was unusually ranged on the left side underneath the *Spleen*, from whence it descended to the Cavity of the *Ileum*, and terminated in a round point, making an Appendix of an inch in length: It was that which made us to distinguish this *Intestine* from the others. Its Figure was not strait, but a little crooked, like the blade of a Scythe. In the concave part of this bending there was a Ligament, and in the convex another, both like to those which are commonly found in the

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Colon of Men; and these Ligaments were accompanied with Veins and Arteries which came from the *Vena Mesenterica*, and spread from space to space their branches into the Body of this *Intestine*.

Two fingers underneath the great end of the *Spleen*, there lay a little Spherical Body very extraordinary, which appeared of the same Substance as the *Spleen*, altho it was remote from it; It was three lines Diameter.

The other *Intestines* were so little different from one another, that we could never distinguish the *Colon*. They were near twenty eight foot long. Having opened them we found in the inside eight Worms long and round, like to Earth-worms, three whereof were between seven and eight inches long, and the rest about four.

The *Spleen* was laid along the left side of the Stomach, to which it was fastened by eight Veins, and as many Arteries, which made so many *Vas Brevis*'s. Its Colour was very Red. Its length seven inches, and its thickness almost equalled its breadth, which was about ten lines.

We observed nothing particular in the *Liver*, save that it was divided into five Lobes of the same Colour, as the Lobes of a Dogs Liver.

The Gall-Bladder was hid under the hollow part of the Liver between two of its Lobes. It was two inches and a half in length, and near an inch in breadth. All the lower *Venter* was overflowed with a diffused Choler, which had perhaps occasioned the death of this Animal.

The *Pancreas* was nothing different from that of Dogs. Its length was ten inches, but it exceeded not two in its greatest breadth.

Though this *Castor* was very Fat, especially through the Belly and Tail, yet there was found very little in the *Tunica adiposa* of the *Kidneys*, and in the *Epiploon*. Each *Kidney* was an inch in thickness, near two in length, and as much in breadth at the middle.

The *Cartilago Xiphoides* was round, and fourteen lines broad; but very thin and pliable.

Having afterwards opened the *Thorax* we observed little difference between all the parts which were there inclosed, and those of Dogs. The *Lungs* had six Lobes, three on the right side, two on the left, and another little one which was in the *Mediastinum* near the Center of the *Diaphragme*.

That which was most remarkable in the *Heart*, is that the left *Auricle* was larger than the right; which is likewise seen in some other Animals, but not in *Man*, who on the contrary has the right *Auricle* of the *Heart* bigger than the left.

We the more carefully sought after the *Foramen Ovale*, which several Modern Authors have averred to be found in all *Amphibious* Animals, and even in *Men*, who do often dive and swim a long time in the water. But what exactness soever we used in the search, we could not discover that hole in the *Heart* of our *Castor*. It is true that as it had been several years penn'd up at *Versailles*, without having the liberty of going into the Water, it might be that this hole was closed up, even as it happens to the *Fetus*, after it is born, and has breathed sometime. Indeed it seemed that in this place there had formerly been a hole which was since grown up.

Under the *Vena Coronaria* we found the *Valve* called *Noble*, which fills the whole Trunk of the *Vena Cava*, and which was so disposed, that the Blood

might easily be carried from the *Liver* to the *Heart* by the *Vena Cava*, but which is hindered from descending from the *Heart* towards the *Liver* through the same Vein.

The *Heart* was two inches and a half long from the basis to the point, and almost two inches broad.

In the Dissection which we made of the *Brain*, the Figure of the *Sinus* of the *Dura Mater* appeared to us very singular. The upper *Sinus* which came from the side of the *Oss. Etmoides* divided the *Brain* into the right and left sides, and advanced in a straight line to the beginning of the *Cerebellum*, where being arrived it was divided into two great branches almost in the form of a Y, which on the right and left did divide the *Cerebrum* from the *Cerebellum*. These two branches produced four others; two on each side, which by returning towards the hinder part of the Head, divided the *Cerebellum* into three unequal parts; that of the middle, which was the greatest, was ten lines in length, and five in breadth, and was Oval: the two other lateral ones were four lines and a half broad, and six long. The whole extent of the *Brain* was in its greatest length, from the Nose to the Temples, but an inch and eight lines, and an inch and half in its breadth.

Having raised the whole Body of the *Dura Mater* by the Anterior part we found no *Falx* under the great *Sinus*. There was only a little Cavity which was formed by the roundness of the *Sinus*, and under the Branches of that *Sinus* there was seen to appear some prints of the like Cavities.

The separation of the *Brain* from the *Cerebellum*, was distinguishable only by those sorts of prints, which were not deep. The *Cerebellum* took up all the hindermost part of the Head. The *Brain* had but very little *Anfractuosities*; and its external part seemed rather White than Ash-coloured. The rest of the *Brain* was like to that of other Animals. The *Mamillares Processus* were very large; but the *Optick Nerves* were very small at their going out of the substance of the *Brain*, and they went joyned together after an extraordinary manner, by reason of the length of this Conjunction, which was seven lines; they were afterwards divided after the usual manner to go to the Eyes, which for an *Orbisa* had only a bony Circle.

As to the *Flesh* of the *Muscles* and of all the rest of the Body, we found nothing particular save that the *Flesh* of the Tail, as we have already observ'd, was different from that of the other Parts.

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The Explication of the Figure of the OTTER.

That which is remarkable in the lower Figure is the Structure of the Paws, whose Toes are fastened each to other by skins as in the *Goose*; The Teeth which are sharp and different from those of the *Castor*; and the Ear which is little as in the *Castor*, but a great deal lower.

In the Upper Figure.

A B. *The Kidney covered with its Membrana Adiposa.*

C C C. *The several little Kidneys discovered, the Membrana Adiposa being taken off.*

D D. *The Ureters.*

E E. *The Emulgent Vessels.*

e. *The Clitoris drawn inwards.*

FF. *The Nymphæ.*

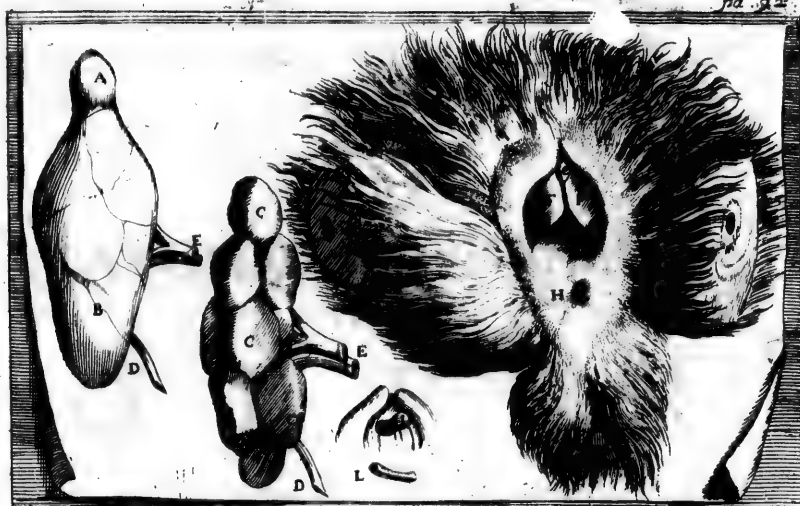
H. *The Anus.*

i. *The Clitoris drawn outwards.*

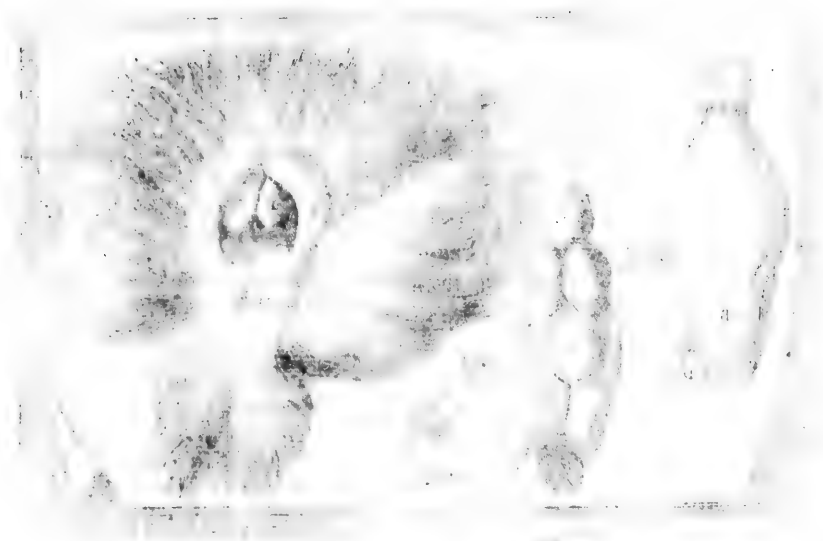
L. *The Bone in the Clitoris.*

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THE ANATOMICAL DESCRIPTION OF AN OTTER.

SOME Authors have confounded the *Otter* with the *Castor*, by reason of the great resemblance that is between these two Animals; but the generality do agree that they are different in several things. We have remarked some which we have not as yet heard spoken of; and there are likewise a great many Particularities which are attributed to the *Otter*, and which are pretended to be common to it with the *Castor* or *Beaver*, which we found not in our Subject.

Pliny, *Belonius*, and almost all the Natural Historians, do say that the *Otter* and *Castor* are only different in the Tail, which is covered with Scales in the *Castor*, and which is Hair in the *Otter*. *Georgius Agricola* and *Alliarius* do make the four Feet of the *Otter* like those of a Dog. All the other Authors do report that it has them like to those of the *Castor*: we found neither the one nor the other in our *Otter*. *Herodotus* says that the *Castor* and *Otter*, even as the other Animals which he calls *square-headed*, have this in common, that their *Testicles* are proper to the Distemper of the *Mother*, and *Brasavolus* affirms that they both have the same Virtue against the *Epilepsie*, *Palsie*, and all the Maladies of the Nerves: In which it appears that these Authors have made no distinction between the *Pouches* of the *Castor* and its *Testicles*, because that the *Pouches* are only made use of in the Distempers of the *Mother* and Nerves. *Aristotle* has likewise attributed to the *Otter* a particularity which *Pliny* reports of the *Castor*, which he declares to be so iraged against Man, that when he bites him, he never quits his hold until he feels the Bone of the Parts which he has seized to crack under his Teeth.

The Greek word *λαυρον*, from whence the word *Lutra* is derived, and which signifies a Bath or Baguio, seems to distinguish it from the *Castor*, because that it plunges only into Fresh-water, and never into the Sea, the water whereof is not proper to wash with, nor to make a Bath; and that the *Castor* goeth indifferently into the Sea and Rivers.

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The size of the *Otter*, and the Proportion of its Parts, did also render it very different from the *Castor* that we Dissected; for the *Castor* was three foot and a half long comprehending the Tail; and the *Otter* had in all but three foot two inches, and its Tail was proportionably much longer; which made the rest of the Body lesser than that of the *Castor*. The Head of the *Castor* was five inches and a half from the Nose to the hinder part of the Head, and that of the *Otter* exceeded not four and a half. The fore-feet of the *Castor* were six inches and a half from the Cubitus to the end of the Toes, and those of the *Otter* not above five. The hinder-feet of the *Castor* were six inches from the Heel to the end of the Toes, and those of the *Otter* but three and a half.

This does likewise render our *Otter* very different from that which *Bellonius* describes, in which he makes the Leggs to resemble those of a *Fox*, and only different in this that they are bigger; unless he would be understood to say that they are bigger in proportion to their length: but the truth is, that in proportion to the rest of the Body they are a great deal shorter than a *Foxes*, being in this like to those of a *Weasel*, which has a long Body and short Leggs.

The hinder feet wholly resembled those of the *Castor*, having five long and slender Toes, not close together like those of a *Dog*, and the intervals had a skin, as in the feet of *Geese*. The fore ones were like those behind, and very different from the fore-feet of the *Castor*: For these toes were joyned by Membranes as those behind, excepting that the Membranes held them closer together; but they had not that resemblance which those of the *Castor* have to a Hand; the five Toes being equal, having each their three Phalanges, and the Pollex not being more separate from the other Toes than the rest are from each other.

The Nose, Eyes, and shape of the whole Head, did hardly render it different from the *Castor*: The Teeth only were unlike, not being sharp, nor so strong as those of the *Castor*; which made us to think that *Aristotle* has mistaken the *Otter* for the *Castor*, when he exaggerates, after the manner already shewn, the strange force of its Biting: for our *Otter* had not those four great and long Incisores which are particular to the *Castor*, and some other Animals, as the *Hare*, *Squirrel*, and *Rat*; all the Teeth being made like those of the *Dog* or *Wolf*, and the Canini being, as is usual, longer than the incisores. So that these Teeth made all the resemblance that we found the *Otter* to have with the *Dog*, altho *Bellonius* reports that it has its Head, and *Ælian* calls it the *River-Dog*. The Ears which were little, as in the *Castor*, were lower than the Eyes, and situated near the lower Jaw.

The Hair was not half so long as that of the *Castor*, containing in that place of the Body where it was longest, but eight lines; whereas that of the *Castor* was eighteen. Its Colour was in some measure different from that of the *Castor*, but not after the manner as Authors do express it: for they do report that the Hair of the *Castor* inclines more to Grey, and we have found the contrary; our *Otter* having the Hair underneath its Throat, Stomach, and Belly much Greyer than it was in our *Castor*. The Hair of the Tail was shorter than upon the Body, but a great deal longer than on the Feet. The rest of the Hair viz. on the Head and Back, was of a Colour resembling that of the *Castor*, being

being of a dark *Chestnut*, and of two sorts, the one longer, Browner, Straiter, and thicker; the other shorter, grayer, more frizzled, and softer.

To finish the Description of the outside, it remains to speak of a Particular very remarkable, and which greatly distinguishes the *Otter*, not only from the *Castor*, but even from other Brutes, which is the extraordinary Formation of the exterior Orifice of the *Matrix*, where we found the *Nympha* and a *Clitoris* as in Women. The *Clitoris*, which was situated at the superiour part of the *Nympha*, and beyond their junction, was three lines in length. It was composed of Membranes and Ligaments which inclosed a Bone two lines long.

The generality of the Parts which were seen by the Dissection, were yet more different from those of the *Castor* than the exterior are. The *Liver* which contained but five *Lobes* in the *Castor*, had six in our *Otter*. The *Spleen*, which was *Cylindrical* in the *Castor*, and very small, not exceeding ten lines Diameter and seven inches in length, was flat in the *Otter*, being an inch and half in breadth and four and a half in length. But its Connexion was so particular that it was not only different from that of the *Castor*, but from almost all other Animals, in which the *Spleen* is generally fastened to the Stomach; whereas in our *Otter* it was at the *Epiploon*.

The *Kidneys* were three inches long and two broad. In the *Castor* they were not two in length: but the principal difference was in the Conformation which was so extraordinary, that it resembled that of the *Kidneys* of a *Bear*; those of the *Otter* differing only in the number of little *Kidneys*, whereof the one and the other are composed: for instead of fifty two little *Kidneys* which we found in the *Bear*, there were only ten in the *Otter*, which were separated one from the other, each having their *Parenchyma*, *Vena*, and *Arteria Emulgens* apart, with a third Vessel, which was a branch of the *Pelvis*, which the dilatation of the *Ureter* produced, and ten branches of which went to each little *Kidney* one. These little *Kidneys*, besides a common Membrane that enveloped them, had store of Fibres which tied and collected them into a heap, which had a Figure somewhat longer than the *Kidneys* usually have; and there was one of these small *Kidneys* which was a little more separated from the rest, and which extended this Figure towards the top, so that this little *Kidney* might be taken for the *Capsula Atrabilaria*.

The *Pancreas* was composed of conglomerated Glands like that of the *Castor*, and generality of other Animals, but they appeared more distinct and separate one from the other than usual.

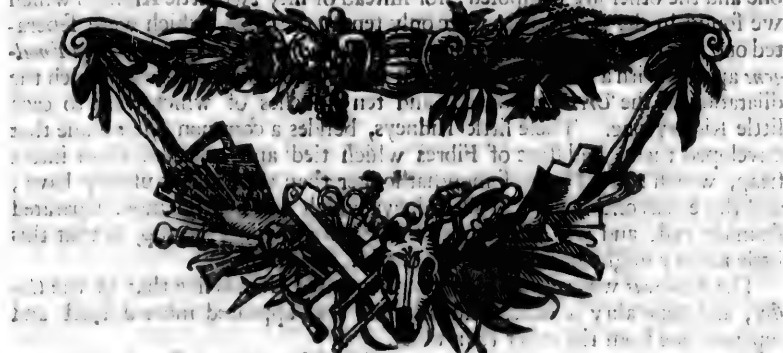
The *Lungs* as in the *Castor* were composed of seven Lobes, six of which was equal in size, and the seventh very small, which seemed only an Appendix of the sixth.

We carefully sought in the *Vessels* of the *Heart* that *Foramen Ovale* which is thought to be in Animals, whilst they do remain without breathing in the Belly of their Damme, for supplying the use which is attributed to Respiration, which is, to assist the Circulation of the Blood which is made through the *Lungs*, by means of the dilatation, and compression of this part. We had formerly made this search in the *Castor*, because that some have thought that that Animal had need of this conformation of the *Vessels* of the *Heart*, to make it able to indure the cessation of Respiration which it undergoes when

it plunges and dives a long time under Water; but we found not this *Foramen* open, nor that there were other Conveyances which might grant passage to the Circulation of the Blood than those which are in the Lungs. Yet the Truth is, that we observed some *vestigia* of this Aperture, which seemed to demonstrate that it had not been long closed: which appeared to us the more probable, for that we were assured that the *Caster* had been a long time shut up in his Hutt without having liberty to plunge into the Water, and that it might happen that this *Foramen* was stopped as it usually is in all Animals a little after their Birth, when the faculty which they have of breathing renders this *Foramen* useless. But in our *Otter* we found not any appearance that there ever had been a *Foramen* which might grant passage to the Blood from the *Vena Cava* into the *Arteria Venosa*; and this sufficiently agrees with the Remarques which all Authors have made that the *Otter* is ever and anon forced to raise it self above the water to Breathe; which the *Caster* does not, having a much greater facility of wanting Respiration for a considerable time. The other Parts which have been carefully Dissected, have furnished us with nothing considerable, and which deserves to be remark'd.

Animal, in which this Aperture is generally supposed to be situated.

It was at the top of the head, and was three inches long and two broad: but the principal difference was in the situation of the Aperture, which was situated in the middle of the head, and not in the middle of the body as in the other Animals.



The dissection was made by Mr. W. and the organs were preserved in spirits of wine.

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The Explication of the Figure of the Civet-Cat.

IT is disposed in such a manner that one may see the Situation of the Pouches in which are the Receptacles of the Odoriferous Liquor, and the three Apertures which are peculiar to this Animal, and which are more distinctly represented in the upper Figure.

In the Upper Figure.

- A A. Is the End of the Penis forceably drawn outwards.*
- B B. The Anus of the Male and Female.*
- c c. The External Orifice of the Uterus.*
- D D.. The place where the Tail is cut off.*
- e. An Eminence being a kind of Clitoris.*
- F F. The Pouches wherein are the Receptacles for the Odoriferous Liquor, covered with their proper Skin, and in their Natural Situation.*
- G G. The same Pouches uncovered and turned downward.*
- H H. The same Pouches yet more uncovered, the Muscles being taken off.*
- I. I. The two Apertures of the Sack, or Receptacles of the Odoriferous Liquor.*
- K. The Uniteing of the three Muscles of the Pouches, or Scents-bags.*
- L. The Sheath in which the Penis lyes concealed.*
- M. The Neck of the Uterus.*
- N. N. The Testicles of the Male, brought sideways to shew them, their Natural Situation being under the Pouches.*
- O. O. The Testicles of the Female.*
- P. P. The Cornua Uteri.*
- Q. Q. The Cremaster-Muscles.*
- R. The Bladder.*
- S. S. The Extremitie of the Cornua Uteri having some resemblance to the Tuba.*

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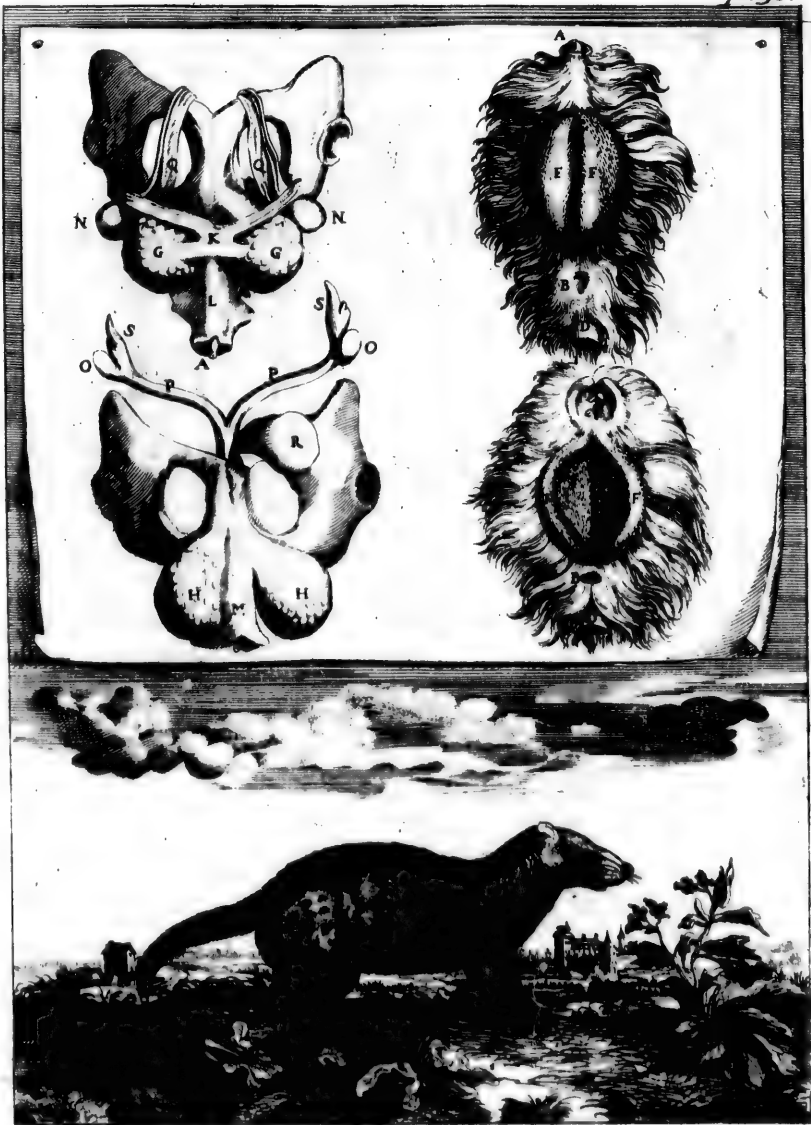
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THE ANATOMICAL DESCRIPTION OF TWO CIVET-CATS

After having made the Dissection of a *Castor* and *Otter*, an opportunity offered of joyning thereunto that of two *Civet-Cats*, which dyed the following Winter in the Parke of *Versailles*. We were very glad of being able to make the comparison of these two Species of Animals, because that they do agree in some Organs, which are very peculiar to them, which are the Receptacles in which there is collected a Liquor, whose Odour is remarkable, for being extremely pleasant in the one, and very disagreeable in the other.

We at first sought whether there was not some particular Reason of this diversity of Scent, but we found not that there was apparently any other than the diversitie of the Temperament of these Animals; for the one is hot and dry, drinks little; and inhabits hot and dry Countreys; the other lives sometimes in the Water, and sometimes on the Land: and as it has a great deal of humiditie, by reason that it participates of the Nature of *Fish*, it has not Heat enough to Concoct and perfect this humiditie. So that suppose that the good and bad Scent do's proceed from the Concoction or Cruditie, which the Natural heat more or less Powerful operates on the Humours, the *Castor*, whose Natural heat is weakened, and as it were stifled by the abundance of its moisture, can only imperfectly Concoct it, and produce only a very unpleasant Scent.

The two *Civet-Cats* of which we made the Dissection, were Male and Female, but so like in all outward appearance, that there seemed no distinction of Sex; it being impossible without Dissection, to judge whether they were not both Females. For the parts which are proper to the Male, were hid and lockt up in the inside; and the Vessel or Receptacle of the Odoriferous Liquor, whose aperture has been taken by most of the Ancients for a mark of the Female, was alike in both the one and the other of our *Civet-Cats*.

From the Mouth to the beginning of the Tail they were Twenty nine

Inches long. The Tails of both had been cut. That which was the longest contained ten Inches. The Feet were very short, especially those before, which from the Belly to the ground exceeded not five Inches. The Paws, as well those before as behind, had each five Toes, the least of which was inward like a Bear's; but this little Toe touched not the ground. Besides these five Toes there was a Spur which was armed with its Nail like the Toes. The Nails were black, strait and very little Pointed. The Sole was furnished with a Skin very soft to the touch. The Ears resembled the figure and size of those of a Cat; but they were less Pointed, and smaller: The rest of the Head had nothing which participates of this Animal but the Beards, which are common to the generallitie of Carnivorous Animals. For the Head was strait; the Mouth long; the Tongue soft; the Eyes little, Black, troubled and long; the Dentes Canini short, and blunt, so that they did seem to have been broken: and it is probable, that this Fierce and Cholerick Animal do's ordinarily break its Teeth by biting the Iron bars of its Cage. The Neck was strengthened and fortified by Ligaments, and Muscles extraordinary strong. Bartholinus has observed that they are far more numerous in other Animals.

The Hair, which was short on the Head, and Paws, was very long on the rest of the Body, being four Inches and a half on the back, where it is longest. Amongst this long Hair, which was hard, harsh, and strait, was intermixt another shorter, softer, and frizled like Wool, as in the Castor, but it was not so fine: It was all over of the same Colour, was a dark Gray. The great hair was of three Colours, making Spots and Lifts, some black, others White, and others Red. There were some of these Hairs which were of two Colours, being Black towards the middle, and White sometimes towards the Root, sometimes towards the other end. The four Feet were Black, as also the Belly and bottom of the Throat, contrary to the Nature of other Animals, which alwayes have the Belly and Throat of a lighter Colour than the rest of the Body, when all the Hair is not of the same Colour. The rest of the Body was intermixt with three Colours, amongst which, Black was the chief. There were two great black Spots at the sides of the Mouth, which encompassed the Eyes, and left the rest very white, excepting the Nose which was black. The Crowne of the Head, from the Eyes to the Ears was gray, by the mixture of the white and black which was in every hair, as has been said, all the ground being black, and the extremity white. The Ears which were all Black on the outside, and only Lifted with White, were filled in the inside with a long white Hair. The Neck had on each side four Black Lifts on a very White ground; and these Lifts which began underneath the Ears, descended obliquely towards the Stomach. The middle of the Back was covered with three Lifts; the middle one was Black, and those of the sides Reddish. The Shoulders and sides upon the Flanks were marked with a great deal of Black and little Red. The Flanks were equally streaked with Black and White, but these streaks were not so continued as those of the Neck; they were rather the spots which Pliny calls Eyes in the Panther, but few of which were single, the greatest part being joynted to each other. The Tail was Black at top, and mixt with a little White underneath.

The Aperture of the Pouch or Sack which is the Receptacle of the Civet, was underneath the Anus, and not under the Tail, as Aristotle places it in his

Hyena,

Hyana, which we together with *Belonius* judged to be nothing else but our *Civet-Cat*; or at least that our *Civet-Cat* is a *Species* of *Hyana*. And this being so, it is very strange that this great Person, who reprehends *Herodotus* for being mistaken, when he thought that the Aperture of this Pouch was the part which denoted the Sex of the Female, and who excuses him upon this Account, that it is difficult not to be deceived, if the thing be not carefully examined, should suffer himself to run into the same mistake, and write in several places, that the *Anus* and Parts of Generation in both Sexes are below the Pouch.

This Pouch was between the *Anus* and another little Aperture, from which it was two Inches and a half distant; but it was nearer the *Anus*. This Pouch was two Inches and a half in breadth, and three in length: Its Aperture which was a slit from top to bottom, was two Inches and a half. At the edges and in-side it was covered with a short Hair turned inwards, so that it was rough outwardly. By parting the two sides of this Aperture, the in-side was seen, the capacity of which would contain a small *Pullat's* Egg; the bottom thereof was pierced on the right and left side, with two *Foramina* capable of receiving the Finger, which did each penetrate into a Sack, supply'd with a White and Rough Skin like that of a *Goose*. The Eminencies which made this inequality, were pierced with as many Pores, out of which was made to come, when squeezed, the odoriferous Liquor, which the *Arabians* do call *Zibet*, which signifies Froth, and from whence is derived the Word *Civet*.

Indeed, this Liquor was frothy in coming out; which was known by this that sometime after it lost the Whiteness which it had at the first. It proceeded, as far as we could judge, from a great number of Glands which were between the two Tunicles, of which the Sacks were composed.

The little Aperture which appeared underneath the great Pouch, was the entrance of a *Ductus*, in which the *Penis* of the Male was concealed; and the Female had such a *Ductus*, which was the Neck of the *Matrix*, whose internal Orifice was so strait, and so difficult to dilate, that it was very hard to make a little *Probe* to enter therein. The external Orifice was covered with two little Eminencies somewhat longish, which were joyned together, and made an Angle, underneath which there was a third Eminence which appeared to be the *Clitoris*.

At the opening of the *Belly* there was found under the Skin from the *Ombilicus* to the Navel, two Eminencies of hard Fat, an Inch broad and thick, and four long. They inclosed the Branches which do pass from the *Hypogastrick* Veins and Arteries, into the two Sacks which do make the great Pouch, there to convey the Matter whereof the sweet-smelling Liquor is made, and which is there collected. *Bartholinus* has very carefully searcht after, tho' not found, the particular *Ductus's*, which he thought to be necessary for the conveying this Matter: But our Opinion is that there needs no other than the Arteries, just as the *Papilla*, and Kidneys have no other which do convey to them the Matter of the Milk and Urine; there being a Faculty in the Glands, that are lockt up in the Sacks of the Receptacle of the *Civet*, which makes them to receive into the Arteries, that which is proper to be converted into odoriferous Liquor, even as the Glands of the *Papilla* do imbibe the Matter which they do find in the Blood, proper to receive the Character of Milk.

These

Hyana,

These Vessels which went to the Bags of the Receptacle were very great in the Male; but could hardly be perceived in the Female. The *Civet* of the Male had also a stronger and pleasanter Odour than that of the Female. Yet Authors do almost all say the contrary; and *Quadranius* in his Treatise of *Theriacæ* prefers the *Civet* of the Female to that of the Male; which he reports to be nothing worth, if not mixed with that of the Female. We found it not to be true that the Scent or smell of the *Civet* is perfected, after long keepings; nor that being new it had an abominable Scent, as *Amatus Lusitanus* reports; for its smell seemed no better to us after a year, than when we made the Dissection. *Plutarch* says that not only the Skin, but likewise the Flesh and Bones of the *Panther* have a good Scent; but we found not that the pleasant smell of the *Civet* was communicated to the inward parts; for it was the Hair only that had a good smell, and especially in the Male, whose Hair was so perfumed, that the hand which had touched it did a long time retain a very pleasant and agreeable smell: which seems to confirm and strengthen the Opinion of *Scaliger*, *Mathiolus*, and several others, who do think that the perfume of the *Civet-Cat* is nothing else but its Sweat; so that it is gathered as *Marmol* affirms, from the Animals which do produce it, after they have been well chased in their Cage; and that it is gathered not only from their Pouches, but likewise from several other places, and especially from about the Neck: there being a probability that tho this Sweat proceeds indifferently from the whole Body, it gathers more abundantly in the Bags, and there grows to greater Perfection.

These Pouches or Bags had some Muscles, which *Bartholinus* mentions not, altho he has marked them in his Figures. Those which we found were different from those which he represents, as well in Number as in Structure. He puts down four, which proceeding from the neighbouring parts, are joyned to the Pouches. Those of our *Civet-Cats* were but three in number, of which there was one, which taking its Origine at one of the Pouches, went to insert it self to the other: the two others took their Origine from the lower part of the *Ishium*, and each came to be joyned to its Antagonist at the middle of the two Pouches, and was fastened to the Pouch over which it went to make this Conjunction.

It were easie for us to conjecture what ought to be the Action of these Muscles by their structure and situation: for that which is common to the two Pouches, must be for their Constriction, by drawing one to the other; and those which do come from the Bones of the *Ishium*, do draw the two Pouches together, sometimes on the right side, sometimes on the left, according as one of the Muscles is contracted, whilst its Antagonist is relaxed. The use of these motions is very probably for the pressing and squeezing out the Odorous Liquor, the retention of which is insupportable to these Animals; when by time it has acquired a piquant Acrimony, which excites them to squeeze it out: for it is observed that *Civet-Cats* do seem to have a restlessness which agitates and torments them, when they have gathered store of this Liquor, which they are constrained to let out.

The *Epiploon* was double and square as usually, but very great. It descended to the *Os pubis* and was composed of rows of Fat which inclosed the Vessels. These rows or bands had each three Angles, and were joyned together by a texture of Net-like Fibres.

The

The *Intestines* were not very long, but especially the *Intestina crassa*, which all three together exceeded not six inches. On the contrary, the *Spleen* was extraordinary long, containing above six inches in length and two in breadth, and a quarter of an inch in thickness. The Colour thereof was livid, inclining to a Blackish.

The *Pancreas* was fastned to the *Duodenum*, and extended towards the *Spleen*. It was an inch in breadth, and four in length.

The *Liver* had five great Lobes, and a sixth lesser than the rest, situated in the middle of the lower part. *Bartholinus* reckons seven. The *Liver* of the Female was much paler than that of the Male, and it was marked with a great many spots of a darker Red.

The *Situation* of the *Kidneys* was such, that the right was higher than the left. They were both fastned to the Loins by a Membrane which we took for the Duplicature of the *Peritoneum*, which held them together as they are in Men, and in some other Animals. *Bartholinus* thinks that this Membrane is that which is particular to them, and which immediately envelops their *Pararenchyma*, but he confesses that it was more easily separated than the proper Membrane used to be.

The *Penis* was situated between the two Pouches in a *Ductus*, as has been already declared. At its extremity it had a bone six lines long, one and a half broad at the narrowest place, and above two towards its extremity, where it was larger, and divided; so that it had as it were two heads, between which there was a void space like a Gutter, to give passage to the *Urethra*.

The *Matrix* was separated into two long *Cornua*, at the end of which were the *Testicles*, whose bigness scarce exceeded that of a great Pea, whose Figure they imitated, being almost round. These *Cornua* produced likewise beyond the *Testicles*, some Appendices of a fat and Membranous Substance, of an irregular Figure, which might be taken for the Fringes of the *Tuba* of the *Matrix*.

The *Lungs* had seven Lobes, three on one side, and three on the other, and a lesser than the rest in the middle in the cavity of the *Mediastinum* near the *Diaphragme*. The *Lungs* of the Female was corrupted and filled with Stones.

The *Heart* was as in *Dogs*. The mouth of the *Aorta* was hardened, and as it were Cartilaginous: and there was a Fat which accompanied the *Vasa Coronaria* even into the substance of the Heart.

The *Muscles* of the *Temples* were very thick, and did cover as in the *Lion* the two upper sides of the Head. In the *Os Frontis* there were six Cavities or *Sinus*'s separated from each other by Spongy and very thin Bones. The *Cerebrum* was divided from the *Cerebellum* by a transverse Bone, as in the generality of Brutes. *Bartholinus* has observed in a *Civet-Cat* a Bone which parted the *Cerebrum* in two, very different from this and all those which are commonly found in Brutes in the inside of the *Cranium*; for it lay long-ways according to the *Sutura Sagittalis*.

The *Glandula Pincalis* was very small, and about the bigness of a little pins head.

The *Aqueous* humour of the *Eye* was muddled; which hapned as we thought, by the dissolution of the Black, wherewith the reverse of the *Iris* is

is besmeared. The *Tapesum* strongly inclined to White. Naturalists do say, that the Eyes of this Animal do shine in the night like those of *Cats*. The *CrySTALLINE* was more convex inward than outward; but that which it had most remarkable, was an extraordinary hardness, which put us in mind of what *Pliny* says of the Eyes of the *Hyana*, viz. that there are thence taken some Precious Stones called *Hyania*.

This Particularity joyned to a great many others, which are found common to the *Hyana* of the Ancients, and to our *Civet-Cat*, made us rather to incline to the Opinion of *Belonius*, (who thought that these are not different Animals) than to that of *Scaliger*, *Ruellius*, *Alexander Benedictus*, *Marshallus*, *Leo Africanus*, *Busbequius*, *Aldrovandus*, and almost all the Modern Authors, who would have the *Civet-Cat* to be unknown to the Ancients, and that it was a Species of *Cat*: for according to our Remarks, the length of the Head and Eyes of the *Civet-Cat*, the smallness of the Teeth and Feet, the harshness of its Hair, the softness of its Tongue, the blackness and rectitude of its Nails, and the hoarseness which all Authors have observed in its Voice, which renders it more like to that of *Dogs* than *Cats*, are Characters wholly different from those which are seen in all the Species of *Cats*. But on the contrary, all that the Ancients have related of their *Hyana* is found in the *Civet-Cat*, some Incredible and Ridiculous things only excepted; as to make *Dogs* silent by its Shadow, as *Aristotle* and *Ælian* report; to know how to imitate the Voice of Men, whom it calls by their Name, to entice them from their Habitations, and devour them, as *Pliny* relates; and to have also Humane Feet, and no *Vertebra* in the Neck, like the Animal which *Busbequius* takes for the *Hyana* of the Ancients; which are Particularities, which *Leo Africanus* has not observed in the Animal which he proposes for the *Hyana*.

For the Description of the Ancients, as to what concerns the exterior Form, consists in three things, which are to resemble the *Wolf* by the Head, to have long staring Hair on the Back, and a particular Aperture under the Tail, besides the two which are commonly there in the Females of other Animals. The two first marks which we very distinctly discovered in our *Civet-Cat*, although, common to other Animals, have seemed to us very convincing, being joyned to the third, which is so particular, that it may be said that there is not known any Animal wherein is found the like. For the Aperture which *Hares*, *Gazella's*, and several other Animals have in this place, has nothing that resembles the extraordinary Figure of this which is in the *Civet-Cat*, and which *Aristotle* has very distinctly observed in the *Hyana* which he describes, by saying, that this *Foramen* is like to the exterior Orifice of the *Matrix* of a Woman.

The sole difficulty which occurs is that the Ancients have not spoken of the Scent of the *Civet-Cat*: which has made *Gillius* to think, that it was the *Panther* of the Ancients, and *Castellus*, that it was an *Hyana* of a particular Species. But it must be considered that most Natural Historians have composed their Works upon the Report of others, and that there is reason to doubt, whether the Hunters who informed them of the Particularities of Animals, were not too gross and rude, as are the greatest part of the Savages which are addicted to this Exercise, to be capable of knowing the goodness of the Scent of the *Civet-Cat*, and in this resemble Beasts that distinguish not the differences

differences of Odours, but as they do relate to eating and drinking; seeing that we do know that the smell of *Civet* is very disagreeable, and offensive to several when it is new, and not mix'd with other Perfumes: but especially Country persons do not think that sweet Odours are pleasant, and do rather chuse the smell of *Garlick* and *Pitch*, than that of *Incense* and *Benjamin*; whence it is, that the *Indians* do call the *Musk-Rat* the stinking Rat. And now in *Africa*, according to the report of *Gregorius a Bolivar*, the *Negro's* which do gather the Liquor which the *Civet-Cats* have left on Stones and Trunks of Trees, do not know it by the smell, but only by a thick and Oily tenacity, which makes them to scrape the places where they do find it, with a design to extract the Odorous Liquor, which swims upon the water wherein they boyl what they have scraped.

This incapacity of judging of good Odours, whereof we do suspect the Hunters of the Ancients, do's otherwise appear very credible; because that Authors have writ, that of all Animals the *Panther* only had a good smell; for it is not probable that these Hunters were of this Belief, only because they never met with a *Civet-Cat*, *Martin*, *Gennet*, *Musk-Rat*, nor any of the Animals, which those who have a subtiler and nicer smell do reckon to have a good scent; but that the reason of this was the defect of their smelling, which was not the Sense they made use of to judge that *Panthers* had a good Odour, as *Ælian* avows, but only the thoughts that this must be so; this Opinion being founded only on the power which they saw that the *Panther* had of drawing Animals to it, which was supposed to be no other thing than a smell which was very pleasing and agreeable to them.

One of the Places
where the *Civet-Cat* is found, is in the
Hills of *Arabia*, where it is said to be
very common.

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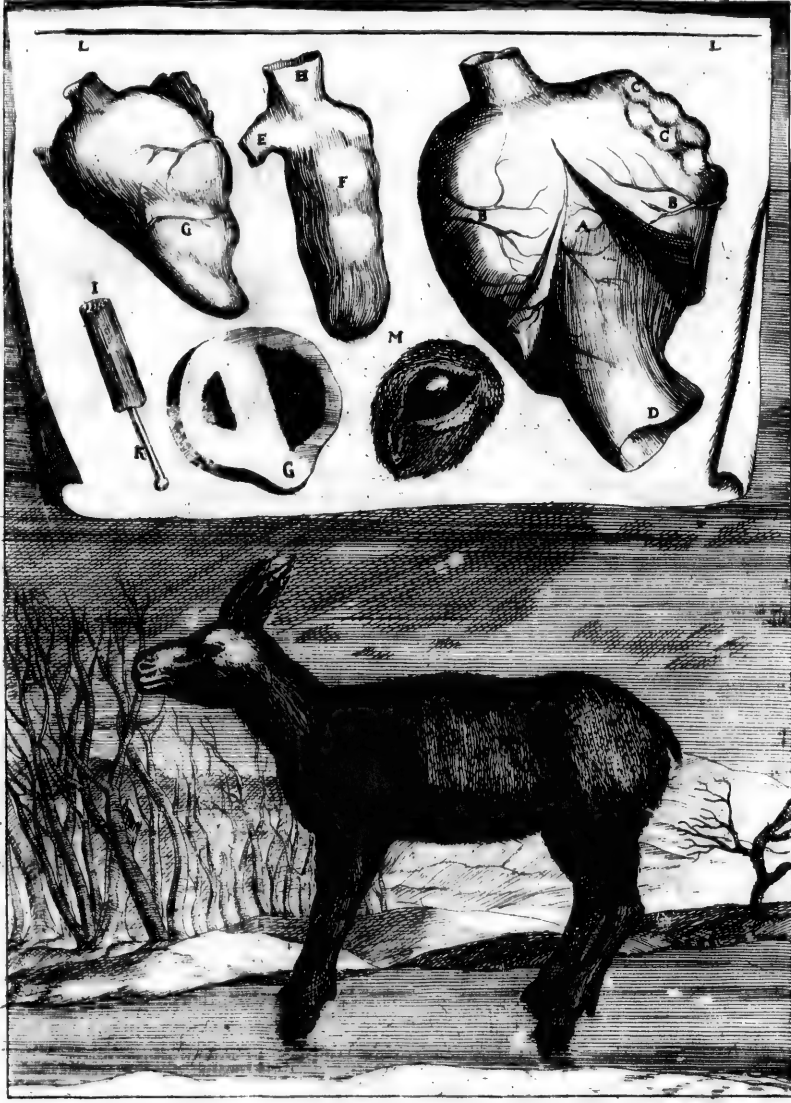
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The Explication of the Figure of the ELK.

That which is remarkable in the lower Figure, is the length of the *Hair*, the greatness of the *Ear*, and shape of the *Eye*; the great *Canthus* or *Corner* of which is *fit* a great way, as also the *Mouth*, which is much wider than in the *Ox*, *Stag*, and other Animals which have *Cloven Feet*.

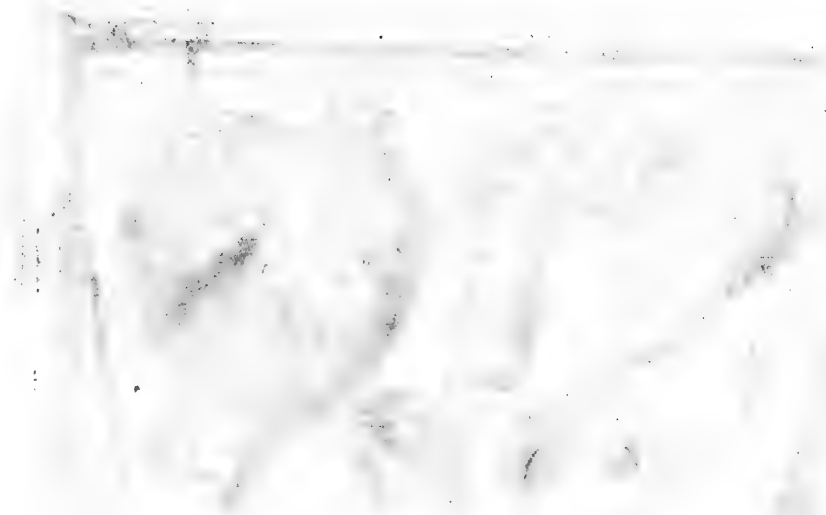
In the Upper Figure.

- A.** The first and largest Ventricle.
BB. A Membrane enclosing that Ventricle, and which might serve for an Epiploon.
CCC. Several Bladders, filled with Wind, that were visible in this Membrane.
D. The beginning of the second Ventricle.
E. The beginning of the Colon.
F. The Cecum.
G. The Cone of the Heart.
H. One of the Hairs cut crossways, seen with a Microscope.
K. The root of that Hair, which is white and transparent.
LL. The whole Hair magnified, but not so much as the Piece.
M. One of the Eyes.



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THE ANATOMICAL DESCRIPTION OF AN

ELK.

THis Animal, which is by all the Northern Writers called *Animal Magnus*; by the Germans, *Elland*, and by the Modern Naturalists *Alces*, appeared to us at the first view not to be the *Alce*, which *Cæsar* mentions in his *Commentaries*, and which *Polybius*, *Solinus*, *Pausanias*, and *Strabo*, have likewise described after him, because that our *Elk* was not found wholly conformable to the Description which these Authors do give of the *Alce*. Yet when we consider, that they do not agree, and that the Descriptions which they do make of the *Alce*, are more different from one another, than that wherein they agree is different from our *Elk*; we thought that all these contrarieties, which are found only in some particulars ill explained, are not capable of hindring our Belief that our *Elk*, and all the *Alces* of the Antients are the same thing.

For the Reason of the diversity of these Descriptions of the Antients is, that the *Elk* lives only in Countries where they had no Commerce. And *Pausanias* reports, that amongst all Animals, the *Alce* is the sole one that is unknown to Men, because that he suffers them not to approach him, by reason that he scents them at a great distance by the extraordinary subtilty of his smelling. But whether it be by this Reason, or by any other, it appears that Authors have very ill examined the *Alce*, which they have described. For some have reported, that it has Hair of different Colours, like the generality of *Goats*; others, that it is all of one Colour, like the *Camels*; some do make it Horned; others without Horns; some do say that it has no Joynts in the Leggs, and so being unable either to lye down, or rise up, it sleeps leaning against a Tree, which the Hunters do saw half through, to make the *Elk* to tumble down, and to catch him; others, that this is not true of the *Elk*, but of another Animal called *Machlis*. All these particulars, how contrary soever, are found in our *Elk*: which demonstrates, that these Descriptions are not different, because that they are of various Animals; but because that those which made them upon the report of others did not well understand

what was told them. For it is true that our *Elk* had hair like a *Camel*, that is to say, all of one Colour over all the Body; and it is likewise held that the Hair of all *Elks* is of divers Colours, but it is at different Seasons of the Year. Indeed our *Elk* which was dissected in Winter had all the Hair of a Grayish Yellow, which is the Colour of the *Camel*; and the Northern Historians do say that it changes at Summer, at which time the Hair grows paler, as in *Deer*, whose Hair is paler in Summer than in Winter; and thus it is probable, that *Caesar* has reported that the *Alce* or *Elk* has Hair of two Colours, upon the relation of those which had seen it in Winter and Summer, and that this diversity having been ill explain'd, he understood it of that which he had remarked in *Goats*, the generality of which have at the same time Hair of two Colours.

So when *Caesar* says that the *Alce* has no Horns, and which *Pausanias* attributes to it, they have both spoken true, because that it may be that *Caesar's* Hunters had met only with Females, which have no Hornes; and that those of *Pausanias's* time had observed that the Males had Hornes.

As for what concern's the Leggs of the *Elk*, which are pretended to have no Joynts, altho some Authors report that there are *Elks* in *Moscovia*, whose Leggs are Joyntless, there is great probability that this opinion is founded on what is reported of these *Elks* of *Moscovia*, as well as of *Caesar's Alce*, and *Pliny's Machlis*, that they have Leggs so stiff and inflexible, that they doe run on Ice without slipping; which is a way that is reported that they have to save themselves from the *Wolves* which cannot pursue them; and likewise by reason of the stiffness of the blows which they do give with their Feet, which are so strong, that when they do miss the blow which they do level at some Beast, they do with their hind-feet break the Trees like *Masbroom's*, as *Olaus Magnus* reports, and that with their fore-feet they have often run the Hunters through.

In fine, that which demonstrates that from this diversitie of Descriptions, which is only in respect of some particulars, it ought not to be concluded that the *Elk* and *Alce* are two different sorts of Animals, is that the very Descriptions, which the Moderns do make of the *Elk*, do not agree together, and are not wholly conformable to what we have observed in our Subject. For some, as *Erasmus*, *Stella*, and *Sigismundus*, do report that the *Elk* has a Solid Foot like a *Horse's*, according to *Pliny*, who makes the *Alce* wholly to resemble a *Horse*, except in the Neck and Ears, which are otherwise proportioned; *Membremus* also, and *Joannes Cajus*, do give it a Beard like a *Goat*, and report that the rest of its Hair is not longer than a *Horse's*: which is not found in other Authors, nor in our *Elk*, whose Foot was Cloven, and altogether like that of an *Ox*. Its Hair was also in every part, not only a great deal longer than in *Horses*, but it even proportionably surpassed that of *Goats* without any appearance of a Beard.

We found not that piece of Flesh which *Polihius* reports, after *Strabo*, to be under the Chin of the *Alce*, nor the hairs which some do make on its Neck, and which *Gesner* avers to have seen in a figure of an *Alce*, which was sent to him by *Sebastian Munster*; but these two particularities being singular to each of these Authors, and no Person having spoken thereof save them, they ought not to prejudice the common opinion, which makes no difference between the *Alce* and the *Elk*.

But that which more confirms this Opinion, is that all the particulars on which the Ancients do agree, are found in our *Elk*; for they do all consent, that the *Alce* is an Animal near upon the Stature of the *Stag*, which it likewise resembles by the greatness of the Ears, and littleness of the Tail, as also by the Horns, which are not found in female *Elks*, nor in *Hindes*. They do also agree in this, that the *Alce* differs from the *Stag* in the length and colour of its Hair, in the greatness of its upper Lip, in the smallness of its Neck, and stiffness of its Legs.

Our *Elk* exceeded five Foot and a half from the end of the Nose to the beginning of the Tail, which contained but two Inches in length. It had no Horns, because it was a Female; and the Neck was short, being as broad as long, which was Nine Inches; the Ears were Nine Inches in length and four in breadth; and there is reason to admire, why those who have thought the *Alce* of the Authors of late Times, which they do take for our *Elk*, was the *Onager*, or wild *Ass* of the Antients, are not grounded upon the resemblance of the Ears, which in their bigness do far surpass those of *Staggs*, *Cows*, and *Goats*, and which have none comparable, save those of *Asses*, which our *Elk* did better resemble by these Parts, than by the Hair, or Feet; although *Scaliger* affirms, that the Feet of the *Elk* are like to those of an *Ass*, and *Stella* and *Sigismundus* report, that there are some *Elks* whose Feet are solid; but there is ground to believe, if this is true, that it is a thing as singular to some *Elks*, as it is extraordinary to *Horses* to have a cloven Foot, and to *Hogs* to have it solid, as *Pliny* reports, that these Animals have in certain Countries.

As to the Hair, the colour of our *Elks* differed very little from that of the *Alce*, the Gray of which sometimes approaches that of the *Camel*, to which we have in this already compared our *Elk*; but this Hair was in some places very different from that of the *Ass*, which is a great deal shorter, and from that of the *Camel* which is a great deal finer. This Hair was three Inches long; and its bigness equalled that of the coarsest *Horse* Hair. This bigness grew lesser toward the extremity which was pointed; and towards the root it was also flattened, but all at once, making as it were the handle of a *Lance*. This handle was of another Colour than the rest of the Hair, being diaphanous like the Bristles of a Hog. This transparent Part had at the extremity a little head or rotundity, which was the root; and it seems that this Part, which was finer and more flexible than the rest of the Hair, was so made, to the end that the Hair which was elsewhere very hard, might keep close, and not stand an end. This Hair, cut through the middle, appeared in the *Microscope* spongy on the inside like a rush; which *Gesner* explains very ill, when he only says, that it is hollow. This Hair was long as a *Bear's*, but straiter and closer, and all of one sort.

The upper Lip was great, and loosed from the Gums, but not so great as *Pliny* makes it in the *Alce*, when he says, that this Beast is forc'd to feed backward, to prevent his Lip from getting between his Teeth. And in the Dissection we observed, that Nature has otherwise provided against this inconveniency, by the means of two great and strong Muscles, which are particularly designed for the raising this upper Lip.

We likewise found the Articulations of the *Legs* strongly knit together by hard and thick Ligaments. Nevertheless it is true, that if one could believe what is reported of the *Elk*, that being very subject to the *Epilepsie*, when

it is fallen into a Fit of the Distemper, it is Freed and Cured, by lifting one of his Feet unto his *Eare*, and that the Hoof of this Foot is an infallible Remedy for the *Epilepsie*. This Animal must have joynts far more supple than those of the *Alce* have appeared to them that thought it had none, and which we have not found in our *Elk*, or at least it is necessary that the *Convulsions* where with it is agitated being in this Condition, do make some very strange Efforts on the Ligaments of the joynts, to extend them so far beyond what they ordinarily are. But if *Olaus Magnus* has writ like an Historian, and if it be not in Rallery that he says that of the two *Claws* which are at the end of each of the *Elk's* Feet, that alone which is on the outside of the right Foot, is proper to cure the *Epilepsie*, there must be supposed a much more admirable Dislocation; and it may be said that the Cure of this Distemper, by the single touch of the *Elk's* Claw, when a Ring of it is worn, is not more strange, nor incredible than the Contorsion that must be conceived in this Foot, to make the Claw, (which is on the outside,) to be put into the *Eare*. So that to understand what *Olaus* means, it is probable that his intention was to deride the imaginary Vertue of the *Elk's* Foot, and that he has very prudently made use thereof. For being unwilling openly to declare his Opinion, which was contrary to that of the Vulgar, who love Specificks, amongst which the Claw of the *Elk's* Foot is the most Celebrated; and seeing that they do not so much esteem the Physicians who do make Profession of using Remedies, as Instruments proper to worke some Cures, as those who do boast of Casting them, if I may so say, in a Mould, by *Fibrifuges*, *Antipilepticks*, *Antipodagricks*, and *Antipilepticks*; This great Man explains himself by a Figure, which leaves those who would be deceived in their Error, without scandalizing them, and which makes others to understand his meaning. For the Proverb being that the Eye must be rubbed only with the *Elbow* when it is sore, to signifie that it must not be touched at all; he has intimated that there is no Claw of the *Elk* which infallibly cures the *Epilepsie*, by saying that there is none but that on the outside of the Foot which the *Elk* can put into its *Eare*, that can do it: for he adds this impossible qualification to a great many others which Authors do mention, and which are very difficult, but absolutely necessary, as it is said, to make this Remedy Operate: as to have been cut off with one blow of an Hatchet, the Animal being alive, on *St. Giles's* day, from a Male which is at Rut, and has not yet engendred; to manifest that the Impostors which would sell *Elks* Claws, have added all these difficult qualifications, to the end that those who have experienced the Claw of the *Elk*, which they made use of, to signifie nothing, may think that it is the want of some one of those Qualifications, which is certainly in that which the Merchant presents them.

Having made those Reflections on the firmness of the Ligaments of the Joynts of the *Elk*, we observed the Figure of the Eye, the great *Canthus* or Corner of which was slit downwards, a great deal more then it is in *Stags*, *Fallow-Deer*, and wild *Goats*, but after a fashion very extraordinary, which is, that this slit was not according to the length of the Eye, but made an Angle with the line which goes from one of the corners of the Eye to the other. The Dissection discovered to us that this slit was proportioned to the *Glandula Lachrymalis*, which was found to contain an inch and a half in length, and seven lines in breadth.

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The internal parts had something resembling those of an Ox, especially in that which concerns the four *Ventricles* and *Intestines*. Nevertheless these Parts had this particular, that the first and greatest *Ventricle* was purely inclosed by a Membrane like a Sack, which having abundance of Vessels might pass for the *Epiploon*; and that instead of the Glands and Fat, which is usually in this part, there was only towards the top some Bladders full of wind about the bigness of a *Chestnut*. The *Intestines*, which were forty eight foot long, had a *Cecum* without an Appendix, which was thirteen inches long, and five broad. It nearly resembled the Figure of a Man's.

The *Liver* was small, not exceeding one foot in length and seven inches in breadth. It was whole, without Lobes, and even without any appearance of the cyst which is over the *Carilago Xiphoides*. It was so joyned to the *Diaphragme*, that it was impossible to separate it from its convex part without cutting it. It had no *Gall-Bladder*, and it was all over, and even to the bottom of its *Parenchyma*, of a gray and livid Colour.

The *Spleen* was likewise very small, being no more than eight inches long and six broad. The Substance of these two *Viscera* seemed very smooth and Homogeneous: but the *Kidneys* were in their external Substance spotted with two different Colours, which made it to appear rough like *Chagrin*, and to the touch nothing but ragged. They were not adherent to the *Loyne* by the Duplication of the *Peritoneum*, but fastned only by their Vessels.

The *Lungs* were divided into seven Lobes, of which there was three on each side, and one at the middle in the Cavity of the *Mediaſtinum*. The inferior Lobes were each as big again as the superiour.

The *Heart* was seven inches long, and five broad. Its Figure was pointed, and from the *basis* to the point there was an Eminence obliquely turned like a Screw, which Eminence answered to the Separation of the two *Ventricles*, so that it seemed to be a fold of the external part of the right *Ventricle* upon the left. This Eminence, which is scarcely visible in the *Heart* of other Animals, was extraordinarily apparent in this. The *Septum* and rest of the *Parenchyma* of the *Heart*, which environed the left *Ventricle*, had the thickness of an inch. The Rings of the *Supera Arteria* were imperfect.

The *Brain*, comprehending the *Cerebellum*, was but four inches in length, and two and a half in breadth. The smallness of this part compared with the greatness of the *Glandula Larymalis*, (which, as has been said, was an inch long,) seemed to us as an Argument capable of confirming the Opinion of those who believe that the greatest part of the Glands which are about the *Brain* do not receive from it the *Humidities*, wherewith they usually are imbued; but that they are brought to them by the Arteries, or by the Nerves, from which they do receive the Matter, whereof they do make the *Lympha*. The Curiosity which we had of exactly seeking out the *Ductus*'s designed to receive and convey these Humours, which must be very visible in a part so extraordinary large, could not be satisfied, by reason of the corruption of our Subject, which had been kept so long, that all the Parts began to dissolve with Putrifaction.

The Substance of the *Brain* differed not from that of the *Cerebellum*, both being very white, and firm enough, notwithstanding the Corruption, to make it appear very sound, in an Animal so subject to some Distempers, whose

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seat is placed in the *Brain*: which according to *Cervinus*, is colder, moister, and more Phlegmatick in this Animal than in any other.

The *Glandula Pinealis* was of an extraordinary size, exceeding three lines in length, like that which we found in the *Dromedary*; but its Figure was Conical as usually, whereas the *Glandula* of the *Dromedary* had the form of a *Trochile*. This greatness, which to us seemed very considerable, in regard of the smallness of the rest of the *Brain*, made us to think that those who, following *Erasistratus*, do attribute to the different Formation of the Organs of the *Brain* the divers Operations of the interior Senses, might fortify themselves in their Opinion by some such like Observations; considering that *Lions*, *Bears*, and other fierce and cruel Beasts, have this part so little, that it is almost imperceptible; and that it is very great in those which are timorous like the *Elk*, which is held to be so fearful, that it dies with fear, when it has received the least wound: and it is observable that he never recovers when he sees the smallest drop of his own Blood.

In the *Brain* we likewise found another part, whose bigness had relation to the smelling, which is more exquisite in the *Elk* than in any other Animal, according to the Testimony of *Pausanias*, as has been already declared: For the *Processus Mammillares*, which are thought to be the Organs of that Sense, were without comparison greater than in any Animal that we have Dissected, being above four lines in Diameter.

The *Brain* was divided into four Lobes, of which there was three on each side, and one in the middle in the Cavities of the Hemisphere. The inferior Lobes were each as big again as the superior.

The *Brain* was seven inches long, and five broad, its figure was pointed, and from the base to the point there was an eminence obliquely running like a Screw, which Eminence answered to the Separation of the two Hemispheres, to that intended to be a fold of the cerebral Part of the right Ventricle upon the left. This Eminence, which is commonly named in the *Man* a *Callosa Anterior*, was as extraordinary apparent in this. The *Brain* and that of the *Man*, made, as an extraordinary appearance in this.

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The Explanation of the Figure of the Corn

The lower figure represents the different degrees of the corn which is sown in the field, and the manner in which it grows. It is also necessary to be observed, that the corn is sown in the field in a regular manner, and that it grows in a regular manner. The figure is also necessary to be observed, that the corn is sown in the field in a regular manner, and that it grows in a regular manner.

Figure of the Corn

A. The figure of the corn is a regular figure, and it is necessary to be observed, that the corn is sown in the field in a regular manner, and that it grows in a regular manner.

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The Explication of the Figure of the Coati Mondí.

THe lower Figure represents the different Colours of its Hair, which is lighter under the Belly, and Stomach, than on the Back, and Paws. It is also necessary to be advertized, that the Snout is somewhat more crooked than it was when the Dissection was made, designedly to express the mobility which was there observed, and the great facility which it had to be raised upwards. The Tail is bent downwards, because it was found thus disposed in the dead Animal. Yet Authors do say that the *Coati* uses to carry his Tail very erect.

In the Upper Figure.

- A. *The Dens Caninus, in form of a Tusk.*
- B B. *The Tongue.*
- C C. *The Os Penis.*
- D. *The right hind-foot.*
- E. *The Spurs of the Heel. All as big as the Life.*

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THE
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THE *Coati* is an Animal of *Brazile*, which is variously described by Naturalists; and their Descriptions do not exactly agree with what we have observed in ours: which may cause a belief that there are several Species of them. *Deleri* in his Voyage of *Brazile* gives it a *Snout* a Foot long, round as a stick, and as small at the beginning as towards the end, very like the *Proboscis* or Trunk of an *Elephant*, to which *Margravinus* also compares this *Snout*: but in his Figure he makes it like that of our *Coati*, which had nothing of an *Elephant's* Trunk but its mobility, which is scarce otherwise than that of a *Hog*. In the Kings Library, amongst a vast number of Animals painted in Miniature with a great deal of exactness, there is the Figure of a *Coati* which some of the Society saw alive; which though it resembles ours, yet is different in some very considerable particulars, such as are the shape of the *Teeth* and *Feet*, which were very extraordinary in our Subject: but notwithstanding it is found to have sufficient resemblance to the Figure which *Margravinus*, *Laet*, and *Deleri* have given thereof, and to that which is in the Kings Library, to make it thought to be a kind of *Coati*.

It was in all thirty five inches and a half; viz. six inches and a half from the end of the *Snout* to the hinder part of the *Head*, and sixteen inches from the *Occiput* to the beginning of the *Tail*, which was thirteen inches long. From the top of the *Back* to the extremity of the *fore-Feet* was ten inches; and there was twelve to the end of the *hind-feet*. Its *Snout* was very long, and movable like that of a *Hog*; but it was straiter and longer in proportion. Its motion was more evident than in the *Hog*, its *Snout* easily turning upwards.

The four *Pans* had each five *Toes*, the Claws of which were black, long, crooked, and hollow like those of the *Castor*. The *Toes* of the *fore-Pans* were a little longer than those of the *hind-Pans*, which were like to those of the *Bear*, excepting that the whole sole was without *Hair*, wherewith the *Heel*

of the *Bear* is covered. The Palms and Soles of these four Paws were covered with a soft and tender skin as in the *Ape*; and this softness of skin was the only thing which our Subject had of the *Ape*, to which we found it had no other resemblance, although it was given us for a *Sagoin*, which is a kind of *Monkey*: for its Tail, whose length in some sort resembled the Tail of the *Apes*, which are called *Cercopithecii*, was different therefrom in the length of the Hair, which is a great deal shorter in the Tail of *Apes* proportionably to their Body. The sole of the *hinder-paws* was long, having a Heel, at the extremity of which there were several Scales a line broad, and five or six long. They grew out behind, heaped together like a *Marigold*, when it closes it self at Night.

The Hair was short, rough and knotty. It was blackish on the Back, in some places of the Head, and at the end of the Paws and Snout. As for the rest of the Body it was mix'd with Black and Red, yet so that the bottom of the Belly and Throat was of a deeper Red in some places than in others. The Tail was covered with a Hair of these two Colours, which formed several Circles, or Knots, the one Black, and the other mix'd with Black and Red.

The Tongue was chop'd with several Fissures or Strokes, which made it to resemble the top of a leaf of a Tree.

The Eyes were very small, like a *Pigs*. The Ears were round like those of *Rats*; and covered at the top with a very short hair, but in the inside with a longer, and whiter.

There were six *Incisors* in each Jaw. The *Canine* were very large, especially those of the lower Jaw. Their Figure had something more particular, not being round, blunt, and white as in a *Dog*, *Wolf*, or *Lion*, but sharp by the means of three Angles, which at the extremity formed a point sharp like an Aule. They were grayish, and somewhat transparent. The Gula was large, and cleft as a *Hogs*; and the lower Jaw was also as in a *Hog*, very much shorter than the upper.

Now there was not found any of these particulars in the *Sagoin*; and these two Animals having nothing common save the Country wherein they do breed, which is *Brazile*, we have found no Description in the Authors which have treated of the particular Animals of *America Meridionalis*, which suites better to what we have observed in our Subject, than that of the Animal which *Margravinus* and *Laet* in their *Brazilian History* do call *Coati*, which is a *Genus* whercof they do make two *Species*; the one has Red Hair all over the Body, and is simply called *Coati*; the other has only the Belly and Stomach of this Colour, which they do call *Coati Mondis*.

In the Description which these Authors do make of this Animal, the marks which we have there described, and which we have met with in our Subject, do all occur except the Teeth and Scales, which are at its Heels, which they have not mentioned, and the Tail, which in their *Coati's* they do make much longer than the rest of the Body. But *Laet* reports that these Animals used to bite off their Tail, and that they do live on it some time, which at last they do wholly devour, and then die. It might be that ours so shortned his. They do likewise say that the *Coati's* have hands made like those of *Monkeys*: which appeared not in our Subject, whose feet were otherwise very like to the Figure which *Margravinus* has inserted in his Book.

By

By the Dissection we found, that under the Skin, and between the Muscles there was a great deal of Fat, white, and hard like Tallow. The *Penis* was hid in a passage an inch deep, and as much broad, whose Aperture was under the Belly, about four Fingers distant from the *Anus*. This *Penis* was provided with a Bone, whose length did in proportion exceedingly surpass that of the Bones which are found in the *Penis* of other Animals which have it. It was thick at both ends, and had a Figure resembling the Bone of a *Pullet's* Thigh. Along the *Penis* there were two *Veins* very large, and full of Blood, which went to the *Balanus*. The *Testicles* were like to those of *Dogs*.

The *Epiploon* was very small. It had little Fat, and was a complication of Fibres and Fillets rather than a Membrane. It was not laid upon the *Intestines*, but tucked upon the *Ventricle*.

The *Spleen* was two inches and a half long. It was of a Dark-red at the side of the *Stomach* in its hollow part, and Blackish at the extremity in its gibbous part. There was not observed any Vessels in the external Membrane of the *Ventricle*, except the *Coronaria Stomachica*, which appeared towards the upper Orifice, and soon disappeared, shooting forth a few Branches.

The *Liver* was somewhat blackish, and of a Substance very Homogeneous, without any appearance of Glands. It had seven Lobes, two great ones on the left side, and five other small ones on the right side. The *Bladder* was between the two upper Lobes.

The *Pancreas*, which was fastned along the *Duodenum*, inclining more towards the right *Kidney* than towards the *Spleen*, was very small. The *Mesenteria* was all filled with a very hard Fat, which inclosed, and almost concealed all its Vessels.

The *Intestines* contained in all seven foot in length. They were all of one thickness, and had nothing which might distinguish them from each other; there was no *Cecum*.

The right *Kidney* was a great deal higher than the left, so that two Lobes of the *Liver* covered it.

The *Lungs* had five Lobes; two on the right side, and two on the left, which were somewhat smaller; and a fifth in the *Mediastinum*.

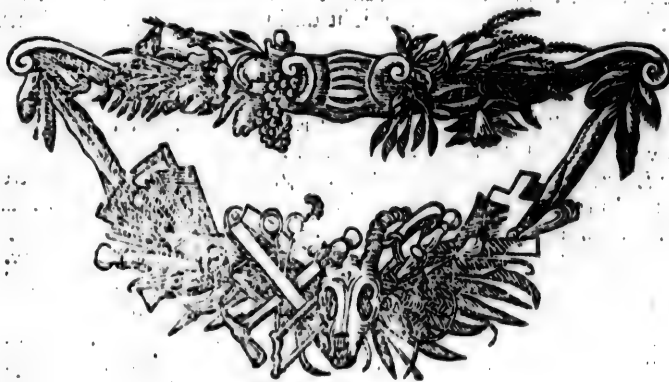
The *Heart*, which resembled that of a *Dog*, had the right *Auricle* extremely great. In the right *Ventricle*, and in the right *Auricle*, there was found a great deal of slimie matter, hardened.

The *Musculus Crotaphites*, passing under the *Zygoma*, was fastned there. It was extraordinary fleshy, even to its insertion, which is made by a very large tendon, which was inclosed between two pieces of Flesh, much thicker than those which are generally found in this place, and which are thought to be there put to defend and strengthen the tendon of the Muscle of the *Temples*.

The *Orbita* was not Bony throughout, but it was supplied in the upper part, by a Cartilaginous Ligament, which joyned the *Apophysis* of the *Os Frontis* to that of the first Bone in the upper Jaw.

The Bone which separates the *Cerebrum* from the *Cerebellum*, was as in *Dogs*. The *Dura Mater* was very adherent to the *Cranium*. The *Sinns* of the *Os Frontis* were full of a matter like a fryable Fat. The *Mamillares Processus* were very large.

The *Globe* of the *Eye* exceeded not four lines and a half in Diameter. The Aperture of the *Eye-lids* was larger, and the *Pupilla* it self was not lesser than the whole *Globe* of the *Eye*. The *Cryſtalline* contained three lines in breadth, and two and a half in thickneſs, and was more convex inwards than outwards. This thickneſs of the *Cryſtalline* made the two other Humours to be leſs in quantity. The *Choroides* was all over of the ſame colour, viz. of a very brown-red, without any *Tapetum*, which is hardly ever wanting in the *Eyes* of other Animals.



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The Explication of the Figure of the SEA-CALF.

THE lower Figure shews the difference that there is between the *Fore-feet*, which are locked up under the skin except the *Paws*, and *hind feet*, which are joyned together, having the form of a Fishes Tail. It may be likewise observed that the *Ears* do seem to have been cut off, having no external *Ears*.

In the Upper Figure.

- A. The Trunk of the Vena Cava.
- B. The Trunk of the Aorta.
- C C. The Venæ and Arteriz Adiposæ.
- D. Ren Succenturiatus.
- E. The right Kidney strip'd of the Membrana Adiposa, and divided by the Gibbous part.
- ffff. Four small particular Pelves.
- F. The Emulgent Vessels of the right Kidney.
- G G. The Emulgent Vessels of the left Kidney.
- H. The left Kidney covered with its Membrana Adiposa.
- G I. The left Spermatick Vein which generally enters into the Emulgent, but which has three other Branches which do fasten it to the Membrana Adiposa.
- K L. The Ventricle, half of which is taken away to represent the Structure of the Internal Membrane, whose wrinkles are undulated and waved in the upper part, and strait in the Lower.
- M M M. The Liver. N. The Gall-Bladder.
- OO. The Heart.
- P. The Vena Cava, which runs along by the Basis of the Heart.
- QQ. The Auricles of the Heart.
- R. The Aorta making the Cross.
- S. The right Arteria Axillaris.
- T. The left Axillaris.
- Δ. The Artery of the Lungs.
- V V. The Carotides.
- XX. The Nervi Recurrentes.
- Y Z. The Vena Cava opened at the place where it is fastned to the Heart.
- Y. The hole which penetrates into the right Ventricle.
- Z. The Oval hole which penetrates into the Vein of the Lungs.
- a. An edge made by the Interior Membrane of the Vena Cava.
- b c. One of the Hairs of the Beard represented twice as big as the Life.
- d. Part of the Scierotica, which with the Cornea not represented makes the half of the Eye cut in two.
- e. The CrySTALLINE.
- g g. The Vitreous Humour.
- h i i. The other half of the Eye.
- h. The Extremity of the Optick Nerve, which enters directly at the Axis of the Eye.
- i i i. Three Branches of Blood-Vessels which do enter into the Eye with the Optick Nerve, and which are ramified in the Retina.
- Q. The Tongue.

T H E

THE
ANATOMICAL DESCRIPTION
OF A
SEA-CALF.

RONDELETIUS has observ'd that the *Sea-Calf* is of two Species, one of which is found in the *Mediterranean*, and the other in the Ocean. But he makes no other difference between each of these two Species than the habit of the Body, which he reports to be fuller in the *Sea-Calf* of the Ocean than in that of the *Mediterranean*, which is not so thick and short as the other. The *Sea-Calf* whose description we make had more resemblance with this second Species than with the first.

It had a long Neck and the Head farther distant from the Shoulders than it is in the *Calf* of the Ocean, so as it is represented in the figures we have of it; and the rest of the Body was likewise straiter. The Breast was broad by reason of the situation of the *Omoplata*, which were forwarder than they are in other Animals, which have the Breast Pointed and narrow when the *Omoplata* are backwarder. The whole Animal was twenty eight Inches in length from the Nose to the end of the hind-Foot, which according to the disposition that they Naturally have in this Animal, were extended and joyned one to the other; having in this only the forme of a *Fish's* Tail, according to the Description of *Aristotle*, which is contrary to that of *Rondeletius*, who represents the *Sea-Calf*, as well that of the Ocean as of the *Mediterranean*, without hind-feet, and who reprehends *Aristotle* for reporting that this Animal has Toes on the hind-feet like to those of the fore-feet; so that it seems that *Rondeletius* has confounded the true *Sea-Calf* or *Phoca* of the Ancients, with the *Sea-Ox* of the *West-Indies* which has no hind-feet, but only a mithapen *Fish-Tail*, which it makes use of for Swimming, which it performs with a very great Swiftnes, according to *Clausius*, who says that he saw one which the *Hollanders* had brought from the *Indies*.

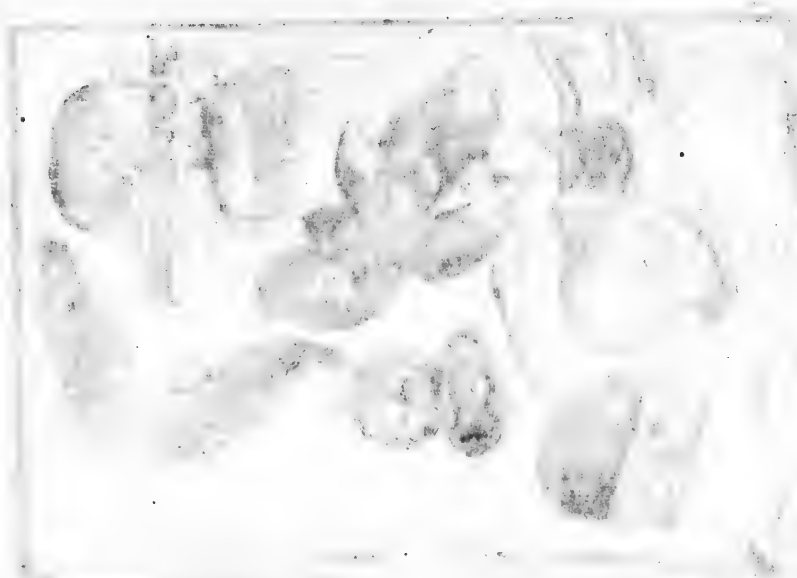
The *Sea-Calf* which we describe had not only two hind-feet, but besides that a Tail of an Inch and a half long, which *Aristotle* justly compares to the Tail of a *Stagg*. 'Tis true that the Toes of these feet were not so shaped nor



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so distinct as in the fore feet, and that these two feet thus extended as they were, and joyned one against the other had rather the Forme of a *Fishes* Tail, than that of the feet of Animals which have any, and which they commonly bend under the Belly. These feet were like to those of a *Ducker*, which cannot walk like other *Birds*, by holding their Body parallel to the ground, but which are forc'd to go upright like man.

Aristotle says that the feet of the *Sea-Calf* resemble Hands: his meaning is that the fore-feet of this Animal, in stead of the three parts which do compose the Arme of a Man, viz. the Arme, *Cubitus*, and Hand, have only the last correspondent to the hand of Man, so that this Part proceeds immediately from the Breast. The *Sea Ox* of the *Western* Islands, which is a kind of *Sea-Calf* of a prodigious bigness, is there called *Manaty*; because that according to *Oviedo's* remarks, it has only the fore-feet, which by the *Spaniards* are in all Animals commonly called Hands. In our Subject the *Brachium* and *Cubitus* were inclosed and lockt up under the Skin which covered the Breast; and there was only the Paws which came outwards. These Paws thus closed and contracted did not seem to us sufficient to serve the Female to imbrace her Young, as *Oppian* reports that she do's, when she carry's them to Sea: They did likewise appear, even as the hind-feet, fitter for swimming than walking; altho' in truth, neither the one nor the other of these feet could well serve to walk conveniently. *Ælian* has observed, that the Females have a great care of carrying and frequently recarrying their Young Ones, sometimes into the Sea, and sometimes on Land; it is probable, that this is to teach them to Swim, and walk, by a long Exercise, which produces a habit capable of supplying the conveniences which Nature has denied them. 'Tis likely that *Homer* calls the *Sea-Calves* *Nepodes*, by reason it may be said, that they do Swim with Feet, and walk with Fins, and not because they have no Feet, as *Eustathius* explains it. These Feet had Claws which were not so necessary for swimming as they are for walking. So that it seems, that Nature, who has made the *Sea-Calf* to live like the *Castor*, on Land and in the Water, has given Organs to each of these Animals to go with more or less ease, according as it has designed them to be more generally in the one or other of these Elements; for the *Sea-Calf*, which is oftner in the Sea, than on Land, walks not with so much ease and facility as the *Castor*; and the *Castor* Swims not so easily as the *Sea-Calf*, because it goes into the Water only to catch *Fish*, and makes not its common residence there.

For these very Reasons, the *Heart* and *Lungs* of the *Sea-Calf* have a particular conformation, to inable this Animal to continue a long time under Water without breathing, as shall hereafter be explained; but the *Castor* which stays not long in the Water, has not this particular formation of the Heart; at least we have not found it in the two *Castors* which we dissected, the one whereof was of *Canada*, the other of *France*.

The Head was not short and round, as *Rondeletius* describes it, and its Nose was long enough to make it resemble the Head of a *Calf*. But the Eyes were not like those of a *Calf*, which has them full, and as it were standing out of the Head; for those of our Subject were hid, and as it were sunk into their *Orbites*, whose upper Edge was not raised, as it is in the *Calf*. Nevertheless these Eyes were large, containing fifteen Lines Diameter. There was an internal Eye-lidd to cover the Eye; it was drawn up and hid in the great *Canthus*.

Over the Eyes there wanted those long Hairs which *Rondeletius* and *Severinus* do there place, and it only had some at the sides of the Nose, which were of a very peculiar Figure, being square and flatted with knots from space to space, and very close to one another, as it is represented in the Figure.

Beyond the Eyes there were holes for the internal Ears as in Birds, and there were no external ones. *Aristotle* has observed that this is peculiar to the *Sea-Calf*, which among all viviparous Animals, is the sole one that has internal, and no external Ears.

The whole skin was covered with a short Hair, very like to that of the *Land-Calf*. *Silvaticus* does ill compare it to that of the *Goat* which is very long. Its Colour was between a Gray and Yellow, somewhat fainter towards the Belly than towards the Back, which was chequered with Spots, about the bigness of ones Nail, of a dark-red. *Pliny* reports that this Hair, a long time after that the Skin has been flead, retains such a sympathy with the Sea, that it follows its motions, and that sometimes it stares, sometimes is smooth, as the Sea swells or is abated by its flux and reflux. *Severinus* declares that he had seen this Miracle; but he expresses it with such excess, that it is the less credible. He says, that when the North-wind blows, the Hairs which were raised by the South-wind are not only laid, but do wholly disappear. *Cardan* affirms that this Property, which had passed for Fabulous, was found true in the *Indies*. Experience has demonstrated to us that this Miracle is never seen at *Paris*. For having kept and observed this Skin for several Months, we found that the Hair was in all weathers of the same height and situation.

The Skin was hard and thick. *Pliny* says that it is impossible to kill the *Sea-Calf* but by breaking its Head. The Historians of the *West-Indies* do report that the Skin of the *Manati* being Tanned is above an inch thick, and that thereof is made the Soles of Shoes.

The Teeth which were long and sharp in both the Jaws, were very unlike to those of the *Calf*, and do better resemble the Teeth of a *Wolf*. So that the *Spaniards* and *Germans* have reason to call this Animal the *Sea-Wolf*. Besides, the mild and heavie disposition of the *Land-Calf* has very little resemblance with that of the *Sea-Calf*, which Naturalists report to be Crafty, Bold, and Courageous, living on Rapine, having the Industry of Assembling with its Kind, to attack the greatest Fishes, and strength enough to defend it self on Land against the *Bear*: which is hardly credible of the *Calves* of the Stature of ours, and can agree only with those which are taken near *England*, which according to *Gesner* are as great as the *Bears*; or rather with those whereof *Gomara Oviedo*, *Pedro Cieza*, and the last relations of the *Ant-Isles* do speak, which are of a size so Prodigious, that there are found some twenty foot long and seven thick. But Names are most frequently given to Fish by reason of some resemblances that they have, as it is pretended, to certain things, whether that Similitude be taken from their shape, or dispositions. Thus the *Sea-Sheep* has this Appellation, because it is white, and has crooked Horns like that of the Land; and the *Sea-Calf* is by some called a *Wolf*, by reason that it lives on Rapine. Nevertheless by this reason it should be called a *Sheep*, if compared to the *Sea-Sheep*; and the *Sea-Sheep* ought on the contrary

contrary to be called a *Wolf*, because that according to *Alian*, the *Sea-Sheep* hunts the *Sea-Calves*, and devours them.

The *Tongue* was very like to that of a *Calf*, being large, flat, and smooth. It was forked, and cut in two at the end, as *Aristotle* has remarked; but not double, round, and small, as in *Serpents*, and *Lizards*, as *Pliny* describes it.

The *Larynx* had a particular formation, the *Epiglottis* being proportionably larger than in other Animals; it went half an inch in length beyond the *Glottis*, to cover it. It is probable that this is done more exactly to close the entrance of the *Aspera Arteria*, when this Animal eats his Prey at the bottom of the Sea, and to hinder the water from running into its Lungs.

The *Ventricle* was in form of an *Intestine*, which was contracted towards its two Orifices. *Severinus* describes it round like an *Ostrich's Egg*. The interior Membrane was folded, and made several wrinkles. *Severinus* describes it without wrinkles. These wrinkles from the Superior Orifice to the middle of the *Ventricle* were waved, and from thence unto the *Pylorus* they were strait. This seems to have some resemblance with the *Ventricles* of Animals which chew the Cud, in which the wrinkles of the lower *Ventricle* are strait, and according to the length of the *Ventricle*; whereas in the upper they are transversal and oblique.

In the inside of the *Ventricle* there was found a round bottom of the Sea-herb called by the Sea-men *Wreck*, which is a kind of *Fucus*. This clue or bottom was of the bigness and shape of a Nut. It closed the upper Orifice of the *Ventricle*, inasmuch that it seemed that this round lump had been push'd into this Orifice by the effort of an extraordinary compression, and by the contraction of the *Ventricle*.

The *Liver* had six Lobes, two great ones underneath and behind, and four small ones at the top and before. The *Gall-bladder* was between the great right Lobe behind, and the first of the small ones which are before of the same side. *Belonius* reports according to *Aristotle*, that the *Sea-Calf* has no Gall: *Pliny* would have it in the Breast; which agrees not with what he relates; that this Animal vomits up its Gall when pursued by the Fishermen, by reason of the knowledge he has that he is taken only for his Gall, which is profitable for the Cure of several Diseases: for it would be impossible for him to vomit up this Gall which is in his Breast, it being incredible that he can understand the intentions of the Fishermen: unless that this Sagacity be peculiar to it, and other *Amphibia*, such as are the *Castor*, *Serpents*, and *Frogs*, which this same Author reports to take care to get rid of the things for which they are sought after; so that the *Castor* tears off the *Pouches* wherein is contained the Medicinal Liquor of the *Castoreum*, the *Serpents* do swallow the precious Skin which they do cast at the Spring, the *Frogs* do daily vomit up certain *Salutiferous* Liquors which are ingendred in their Bodies, for fear of being killed for this Liquor.

The *Kidneys* resembled not those of the *Otter*, as *Rondeletius* says, because the *Kidneys* of the *Otter* are composed of several small separate ones, which have each their *Emulgent Vessels* and particular *Ureters*, as is represented in the Figure of the *Kidneys* of the *Bear*. The *Kidneys* of our Subject were more like to the *Kidneys* of the *Land-Calf*, being cleft at top only in their Surface by chops which did not sink very deep: but these chops were much more

numerous than in the *Land-Calf*, and they made this Kidney to seem composed of several Glands joyned together. These Kidneys did likewise differ from those of the *Land-Calf*, in that besides the great *Pelvis* which is in the gibbous part of that Kidney, there were several other small ones scattered in several places in the Substance of the Kidney, insomuch that it seemed that every of these small *Pelves* appertained to each of the little particular Kidneys of which the great one was composed, and that the *Parenchyma* of every of these particular Kidneys made but one single Mass. The *Membrana Adiposa* of the Kidney was all interspersed with very visible Vessels, which made *Rondeletius* to say that the Emulgents enter not into the Cavity of the Kidney in the *Sea-Calf* as in other Animals, but that they are distributed over the whole Body of the Kidney. The greatest part of these Vessels in the left Kidney were the Branches, or rather the Roots of the Spermatick Vein, which by reuniting did form three great Branches, which the Trunk of the Spermatick Vein, that proceeds from the Emulgent, did by the way receive. This left Kidney was accompanied with a *Succenturiatus*, which was about the bigness of a *Filbert*, and immediately adhering to the Trunk of the *Vena Cava*.

The *Lungs* had but one Lobe on each side, which was only a little transversely cut through the middle.

The *Heart* was round and flat. Its *Ventricles* appeared very large, and its *Auricles* very small. The Trunk of the *Aorta* proceeded from the Heart two inches in length before it returned downwards. Underneath the great Aperture through which the Trunk of the *Vena Cava* conveyed the blood into the right *Ventricle* of the Heart, there was another which penetrated into the *Arteria Venosa*, and from thence into the left *Ventricle*, and afterwards into the *Aorta*. This hole, which is called the *Foramen Ovale* in the *Fetus*, makes the *Anastomosis* by the means of which the blood goes from the *Cava* into the *Aorta* without passing through the Lungs; and it is apparently for the same use that this passage is found in the *Sea-Calf* and *Fetus*, by reason of the necessity which each have of living without respiration, viz. the *Fetus* whilst in the Womb of its Mother, and the *Sea-Calf* whilst under water. Which demonstrates that Respiration is necessary for the Circulation, and that the Blood which the Lungs have received from one of the *Ventricles* of the Heart by being dilated, is afterwards thrust into the other *Ventricle* by the compression of the Heart. And it is probable that the facility which the *Sea-Calf* has of Diving a long time under water, must rather be attributed to this particular formation of the Vessels of the Heart and Lungs, than to the smallness of the Lungs, which is the reason that *Pliny* alledges.

Between these two holes which were in the Trunk of the *Vena Cava*, there was a Membranous separation made by a fold of the interior Coat of the Vein.

In the *Ventricles* of the Heart, and in the Lungs, there was found great store of Blood. *Pliny* reports that these parts in the *Sea-Calf* do contain less blood than in other Animals. This blood being kept congealed very firmly.

Aristotle and *Pliny* do affirm that the Bones of the *Sea-Calf* are Cartilaginous: we found that they were real Bones very hard, especially those of the *Cranium*. The *Dura Mater* was fastned to the Skull, and redoubled to make the

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the *Falx*. There was a bone between the *Cerebrum* and *Cerebellum* like as in *Dogs* and other Animals which do live by Rapine, and which do eat Flesh, and not Grass, like the Calf. This Bone was flat and pointed, and not round and massie, so as that which is found in the Head of the *Lamantin*, which is a kind of *Sea-Calf* of the *West-Indies*, and which is held to be a Bone which has a peculiar Vertue for dissolving the Stone of the Kidneys and Bladder.

The Sinuosities and Cavities of the *Brain* were as in the Calf. but there was more of the *Cerebellum* proportionably than there is in the head of a Calf; which is unusual in Fishes, which have very little *Cerebellum*. The *Glandula Pinealis* was two lines in length and little less in breadth. Naturalists have observed that this Animal participates nothing of the Stupidity of Fishes, but that it equals the most subtil Sagacity of Terrestrial Animals. *Pliny* testifies that there were shewn some at *Rome* which answered when they were called, and which with voice and gesture saluted the People in the Theatres. *Gomara* makes mention of a *Manati*, or *Sea-Calf* of the *Indies* of a prodigious size, which being tamed, did come when it was called by its name, and carried ten men upon its Back in a Lake where an *Indian* Prince kept it. *Aldrovandus* reports that he saw one which did Sing for the *Christian* Princes and not for the *Turks*.

The *CrySTALLINE* was almost Spherical after the usual manner of Fishes, and the more convex part was before, contrary to what is usual. The whole *Choroides* was besmeared with a white and very opaque substance. In the *Retina* there were three branches of blood-vessels, which did enter into the Eye with the Optick Nerve, and were spread over the whole Membrane. This Optick Nerve did enter into the middle of the Eye, and its entrance was directly opposite to the *CrySTALLINE*.

These two Remarks are favourable to the Opinion of those which do hold that the reception of the visual Species is made on the surface of the *Retina* and not the *Choroides*; because that the Vessels which being spread into the *Retina* are laid upon the *Choroides*, must, by reason of their Opacity, oppose the passage of the visual Species, and hinder them from going to the *Choroides*: which these Vessels do not in regard of the *Retina* because, that it covers them with its surface which terminates and locks up the *Vitreous Humour*. The Situation of the Optick Nerve which was found in the *Axis* of the Eye, and which by consequence did directly receive the visual Species, seems to demonstrate that it is not the *Choroides* which receives the Species, seeing that there is no *Choroides* at the principal place where the Species do fall; but that it is the *Retina* which is extended over the Optick Nerve as well as on all the other places on which the Species may fall.

The left Eye was contracted, and a great deal less than the right; and was found to have been hurt, the Humours being half suppurated. In the Eyes of this Subject there was not found the thousand Colours which Naturalists report to be there observable.

The Explication of the Figure of the Barbary Cow.

THE lower Figure is to discover the extraordinary length of the Head, the situation of the Eyes which are very high, the winding of the Horns, the length of the Neck, the Bunch which the Shoulders do form on the Back, that which is at the *Sternum* as in the *Camel*, the smallness of the Tail, and other particularities which do render the Figure of the Animal different from the ordinary Cow.

In the Upper Figure.

- A. Is the great Ventricle.
 B B B. The three other Ventricles.
 C C. The Origine of the Epiploon.
 D D. The Pancreas.
 E. A part of the *Alpera Arteria* in its natural bigness.
 e e e. The Membranous part of the *Alpera Arteria* on which the *Oesophagus* lies, and which is towards the *Vertebra* of the Neck.
 e e e e. The Extremities of the half Rings of the *Alpera Arteria* flatted and enlarged, making as it were the Wings which do cover the Extremities of the other half Rings which are underneath, and are represented by f f f.
 g g. The hollow and Channellared part of the half Rings.
 F F. The Liver.
 G. The Gall-Bladder.
 I. The Trunk of the *Vena Porta* fastned to the Liver.
 H. Half of the Trunk of the *Vena Porta* loosd from the Liver, to discover its interior surface.
 I I. The holes of the branches of the *Vena Porta* which do enter into the Substance of the Liver, with the Valves which do half stut them.
 K. The Head seen in another Aspect than that of the lower Figure, to represent the particular winding of the Horns.
 L L L L L. The five small Lobes of the Lungs.
 M M. The two great Lobes.
 n. The Ligament which fastens the two great Lobes to one another.

T H E

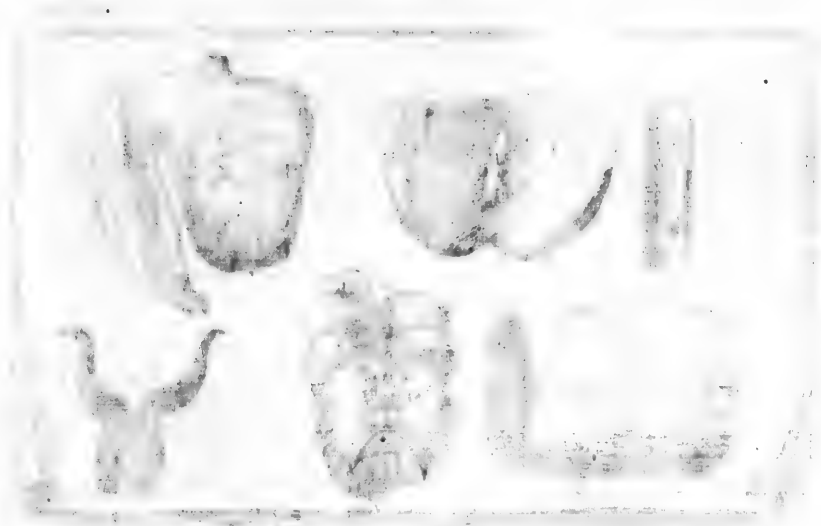


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T H E
ANATOMICAL DESCRIPTION
O F A
BARBARY COW.

THis Animal was about the size of a Cow. Its Hair was of a Fox-red, paler towards the point than the root. It was a little shorter than it commonly is in Cows, and almost of the same bigness towards the point as the root: which is contrary to the Hair of Animals, which is most frequently bigger towards the root than towards the other end. Yet we have before remarked an irregularity opposite to this in the Hair of an Elk, which was a great deal smaller towards the root than towards the middle.

The disposition of the Body, Legs, and Neck made it better to resemble a Stag than a Cow, of which it had only the Horns, which were in a great many things different from those of Cows. They were each of them a foot long, and took their rise very near one another, by reason the Head was in this part exceeding narrow. They were very thick, bent backward, black, wreathed like a Screw, and worn before and at top, so that the raised parts which formed the Screw, were there wholly effaced. The Tail was larger at its beginning than towards its end, after the manner of all the cloven footed Quadrupeds of Barbary which we have Dissected. It exceeded not thirteen Inches in length comprehending a tuft of black hair three inches long, which it had at its extremity. The Ears were seated not at top of the Temples, and underneath the Horns as in Cows, but more backward: as for the rest they were like to the Ears of the Gazelle, being covered in the inside with a white Hair in some places, the rest being bald, and discovering a skin perfectly black and smooth. The Eyes were so high and so near the Horns, that the Head seemed to have almost no fore-head.

The Teats were very little, very short, and only two in number: which rendered them different from those of Cows. The Shoulders were very high, making a bunch at the beginning of the Back. There was another bunch opposite to this of the Back, viz. at the bottom of the Sternum, like as in the Camel.

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We found that all the particulars which are observed in this Animal were seen in the *Bubalus* which *Aldrovandus* describes, and the Figure of which was sent him by *Horatius Fontana*. There is only the bunch of the *Sternum* which neither *Aldrovandus* nor *Fontana* do speak of. It is probable that this Animal ought rather to be taken for the *Bubalus* of the Ancients, than the little *African Ox* which *Belonius* describes: for *Aristotle* compares the *Bubalus* to the *Stagg*. *Ælian* reports that it is very nimble footed; *Oppian* attributes to it Horns bent backward; and *Pliny* avers that it altogether resembles a *Calf* and a *Stagg*. But there is not found any of these marks in the Animal which *Belonius* describes, and they all occur in the Animal which we speak of, as may be easily demonstrated, if reflection be made on all the particulars before remarked. But it is no wonder that *Belonius* is deceived in attributing to his little *Ox* the name of *Bubalus*, seeing that *Pliny* testifies that even in his time this word and appellation was very equivocal, and that it was given to Animals which had no similitude with the *Bubalus*.

As for the inward parts, the *Epiploon* inclosed and covered the *Ventricles*. It was Composed of a Membrane very thin, but continued and not pierced. The Vessels were included in a thick Caul. Its Ligatures were fastned to the two last *Ventricles*, viz. from the *Pylorus* to the second *Ventricle*, to the upper part which touches the *Diaphragme*, and from thence it extended over the two first, by bending it self towards the left side,

The *Ventricles* were in number four. The first and greatest was velvety with an infinite number of small Teats, which made the exterior surface of the internal Membrane of this *Ventricle*, as it is in the generality of other Animals which chew the Cud: but this Membrane was easily separable from the external as in the *Gazella*. The second *Ventricle* had its internal Membrane in form of Net-work; and this Net-work, as in *Sheep*, was nothing else but the Folds of this Membrane, which was looser than the external; and these folds were of different Figures, some Triangular, others Square, and others Pentagonal. The third, as usual had its internal Membrane much looser than the second, and the folds which it had were more raised, but they were all ranged long-wise, making as it were leaves indented. The Fourth, which alone was greater than the Second and Third together, was likewise filled with Leaves; but they were without indentures, and their Situation was transverse, as it were to stop and retain the Nourishment a longer time. Such a Structure has been observed in the *Sea-Fox*, where the Cavity of the *Intestine* was interrupted by Membranes transversly situated, and disposed like a *Snail-shell* or Newel of a winding Stair-case; and this very transverse Situation of Leaves has been found in the *Cæcum* of *Apes*, in the *Colon* of *Hares*, and *Rabbits*, in the *Colons* and two *Cæcums* of *Ostriches*, and in the *Jejunum* of *Man*. The Colour of this last *Ventricle* was very different from that of the others, being of a very darkred.

The *Intestines* were all together seventy and eight feet. The *Cæcum* was eighteen inches long, and three broad. It had a Nervous Ligament, which nevertheless caused not any Cells.

The *Pancreas* was fastened along the little *Ventricles*. The *Spleen* was ten inches in length and four in breadth. It was half joyned to the *Ventricle*.

The

The *Liver* was round and without Lobes, being only a little cleft before and behind. In the Trunk of the *Vena Porta* there was observed little Membranes in form of Valves, which half covered the holes of the branches which do carry the blood from the Trunk of the *Porta* into the Substance of the *Liver*, to hinder it from returning into the Trunk. These Valves which have not been yet seen in the *Liver* of any Animal, are very favourable to the Pulsation, which *Glisson* attributes to the branches which the *Porta* casts into the *Liver*: for this pulsation, which he thinks to be communicated to them by the Arteries, which are joyned and fastened to them by the assistance of a *Capsula*, which incloses the Vein with the Artery: this *Capsula* having a particular motion of constriction, is not easie to conceive without these Valves; it being hard for the blood lock'd up in these Veins to form any pulsation when it is struck by the dilatation of the neighbouring Arteries, if not inclosed and retained by some adjoining obstacle, such as is that of the Valves; otherwise it will necessarily flow back into the Trunk, and Branches which do convey the blood thither; for the impetuosity of the motion of this blood towards the trunk cannot supply this obstacle, as *Glisson* pretends, by reason of the weakness of the Tunicle of the Veins, which do bring this blood into the Trunk: for these Veins would have more need of a *Capsula* to be strengthened, than the branches which are in the *Liver*, the *Parenchyma* whereof might be sufficient to strengthen them. So that it seems that for want of these Valves, the beating would be much greater in the Branches which do convey the Blood into the Trunk of the *Vena Porta*, than in those which do distribute it into the Substance of the *Liver*; and that this beating must be as contrary to the motion of the blood contained in these branches, as advantageous to that which must be distributed in the *Liver*.

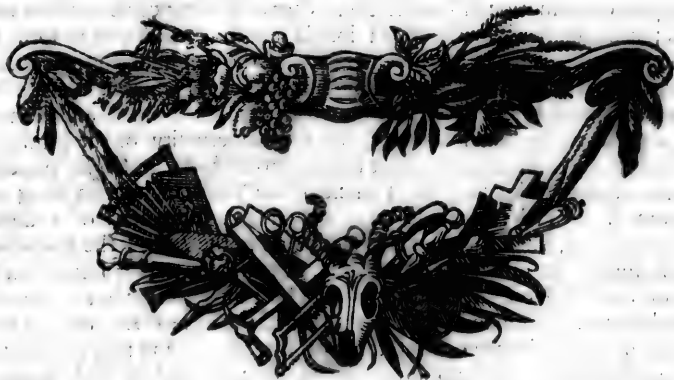
The *Gall-bladder* was at the extremity and on the edge of the hollow part on the right side. It was fastned to the *Liver* by its internal half, and the Membrane which made the outward half was thin, fine, and all folded, being intirely void of *Gall*.

The *Lungs* had seven Lobes: the five upper ones were small; the two lower contained nine inches in length and five in breadth. They were fastned to each other towards the middle by a Membranous Ligament half an inch broad, and two thirds of an inch long.

The Rings of the *Aspera Arteria* which were imperfect, did leave the space of a fingers breadth without a Cartilage at the place towards the Back-bone, and which touches the *Oesophagus*. These Rings were of such a Figure, and so disposed, that their extremities flatned, and enlarged, did each form as it were two Wings or Auricles, which were laid one upon the other; so that for instance the lower Wings or Auricles of the first Cartilage were covered with the upper Wings of the second, which with its lower wings did likewise cover the upper wings of the third, which did cover its lower wings with the upper ones of the fourth. This continued after the same manner in all the Cartilages of the *Aspera Arteria*, as is represented in the Figure, which alone can sufficiently demonstrate this extraordinary Structure. The residue of every Ring, which was the hardest part, was hollow in its middle, and left two eminencies at its sides. This conformation did in this place make the *Aspera Arteria* more rough than it generally is; because that the inequality

equality of the two different Substances which compose it, namely, the Membrane, and Cartilage which is found in all sorts of *Aspera Arteria*, this had over and above the inequality which the Cavities or Indentings, that were in each Ring, did make.

The *Cornea* in the *Eye* was of an oval Figure, as it usually is in other *Corns*. The *Iris* was *Yellow*, a little inclining to *Red*. The *Crystallinus* was more convex behind than before.



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The Explication of the Figure of the CORMORANT.

IN the Lower Figure is observable the length of the Head, the smallness of the Eye, and its oblique Situation, the crooked Figure of the Bill, and the extraordinary Structure of the Feet which have the great Toe outwards, and the others inwards, being all four webb'd together by Membranes.

In the Upper Figure.

- A B. *Represents the Oesophagus blown up, and tied at the top.*
- B C. *The Ventricle blown up.*
- B. *The place where the Oesophagus is straitned so make the upper Orifice of the Ventricle.*
- D E. *The Aspera Arteria.*
- E. *A knot made of a Bony Ring at the bottom of the Aspera Arteria.*
- F F. *Two Musculous Ligaments which do fasten the Aspera Arteria with the Bladders of the Lungs.*
- G. *The Heart.*
- H. *The right Lobe of the Liver.*
- I. *The left Lobe.*
- K. *The third Lobe, which is under the two others.*
- L. *The Gall-Bladder.*
- M. *The Pylorus.*
- N. *A part of the Oesophagus, the inside of which is represented.*
- O. *The Superiour Orifice of the Ventricle.*
- P. *A part of the Ventricle which is seen on the inside.*
- q q. *The Membranes of the Ventricle cut asunder, the interior of which is composed of an infinite number of longish Glands conglomerated, and whose points do make the internal Superficies of the Ventricle rough like Chagrin.*
- Q. *The Larynx.*
- R. *The Tongue.*
- S T. *The right Foot.*
- T. *The Serrate or toothed Claw which is on the second Toe.*

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THE
ANATOMICAL DESCRIPTION
OF A
CORMORANT.

THIS Bird is called a *Cormorant*, that is to say *Crow-Marine*, because that it is generally all black, and is an Aquatick Animal. *Gesner* says that it is for this reason that it is by *Albertus Magnus* called *Carbo aquaticus*. *Gaza* is of Opinion that the *Corax* of *Aristotle* is this very Bird, not only by reason of the *Greek* Name, which signifies *Crow*, but likewise of the other marks by which this Philosopher designs it, which do perfectly agree with the *Cormorants* that we describe.

It was twenty seven inches from the end of the Bill to the extremity of the Tail, and three foot and a half from one end of the Wings expanded to the other. There are seen a great many larger on the Sea-Shore. Its whole Plumage was Black, or a very dark gray, somewhat greenish on the wings, except the Belly, and under the Neck, which were covered with white Feathers, the end of which was blackish: which made these white parts to seem spotted with brown, *Gesner* reports that in *Switzerland* these *Cormorants* which are there called *Scharbi*, that is to say *Coals*, have some of them white Bellies.

Under the great plumes which cover the Body, there was a gray down extremely fine and thick, as in *Swans*. *Aldrovandus* reports that the Skins of *Cormorants* are prepared like those of *Vultures*, and used to cover and warm the Stomach.

The Feathers which did garnish and adorn the Neck were very short, and those which did cover the Head much shorter: but they were very thick and small like Fringe. This demonstrates the *Cormorant* not to be the *Phalacrocorax*, which is so called; because it has no Feathers on the Head, and that *Pliny* is deceived, when he says that the aquatick *Crow*, which is the *Cormorant*, is naturally bald, and that this particularity has given it the name which it has amongst the *Greeks*. *Belonius* held the same Opinion. These Plumes upon the Head were four lines in length, strait, and staring. This made the Head to appear less flat than indeed it is, although it very much appeared so with these Feathers.

Towards

Towards the root, as well of the upper as lower Beak, there was a Skin without Feathers: it was likewise extended round the Eye. This Skin was Red. *Aldrovandus* reports that it is generally white, and *Gesner* makes it of a *Saffron*-Colour. This same Skin was extended under the Beak, upon the Cavity which is generally there. In this place it was of a Pale-yellow.

The *Bill* at the sides was Gray mix'd with Red, and Black at the top. It was three inches in length, from the opening to its extremity. It was crooked, and very pointed at the end. This *Beak* served him to catch Fish; but because that he could only swallow them backwards, or sidewise, and could not conveniently swallow the Tail first, by reason of the Fins, Crests, and Scales, which hindered them from entering into his Throat, he used to cast them in the Air, to receive them with the Head first: which he does with so much dexterity that he never misses. This Bird is made use of for Fishing, by putting an Iron Ring at the bottom of its Neck, to the end that the Fish being received into the *Oesophagus*, which is very large, making a kind of *Craw*, might not enter into the *Ventricle*, and they might easily be made to cast them up.

In the *Beak* there was not any hole for the Nostrils, although in the Palate there was one large enough to permit the Vapours to rise up to the Organs of the Smelling.

The *Eyes* were small, and situated very near the *Bill*. Being shut, the line which the Eye-lids made, was somewhat more oblique than it generally is in Birds.

The *Feet* were short, not exceeding four inches from the Belly to the Ground, and there were seven to the end of the greatest Toe. These Feet were very black, and shining, covered with long, and strait Scales in the inside of the Foot, and on the middle of the Toes. These four Toes were webb'd together by some Membranes, which we have already remark'd in a *Scotch Goose*. These Membranes were speckled like *Chagrin*. These four Toes, which were all of a row, went lessening from the great to the little one. The great and little one did make a right Angle, the great one being on the outside, and the little one on the inside. The two other Toes were likewise on the inside, between the great and little one; which is unusual in other two-footed Animals, especially Man, whose Foot has the great Toe inwards, and the others outwards: for this is so made to support and more firmly to settle the Body on the Feet, on which the Prominence or Protuberance which the toe has on the outside is necessary, to hinder it from bending on either side; but this prominence is wholly useless on the inside; because that the opposite Leg sufficiently supports the Body on that side. These Toes had sharp and crooked Claws: the greatest exceeded not five lines. Yet there was thus remarkable in these Claws, that those of the second toe, which is next to the greatest, were serrate or toothed in each Foot, on the side towards the third toe. The great toe, which was three inches long, was composed of five bones or *Phalanges*, the next of four, the third of three, and the fourth, which is the least, of two. This last was an inch long. *Aristotle* reports that the *Cormorant* is the only *Ducker* which Perches on Trees, and which makes its Nest there. We have observed that the Feet like those of our *Cormorant*, are more commodious for Perching than are those of other

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Duckers, though these feet can clasp the branches only with two of their four toes, namely, with the greatest, and least: but this little one is much larger than in other *Palmipedes*, which have the little toe behind so short, that it is only as a Spur, absolutely useless to gripe the branches.

The construction of the Foot of our *Cormorant* appeared to us not only more commodious than it is in other *Palmipedes*, in regard of the facility which is given it to Perch it self; but is also very advantageous for Swimming: for whereas other *Palmipedes* have only two Membranes, which do joyn the three toes before, our *Cormorant* had three which webb'd the four toes together: for which reason these Birds do go under water with an incredible quickness. *Gesner* reports that the feet do sometimes serve them to catch the Fish, and that they do bring it to the Shore holding it with one foot, and swimming with the other. This particular use, *viz.* of having occasion to swim with one single foot, may make us to comprehend the reason of the extraordinary Structure of the *Cormorant's* feet: for if the toes and their Membranes which do form the foot, had been outwards, it would have been impossible for the Bird to go otherwise than by turning round when it swims only with one foot, as it happens to a Boat when rowed but with one Oar; whereas the toes being inwards, it happens that when the Bird swims with one single foot, it strikes the water exactly under the middle of the Belly, and makes not his Body to waddle on the one side or the other. Now this formation was so much the more necessary, as its feet are shorter: for if they had been longer, they would have had a facility which they have not to be turned obliquely under the Belly, to place the foot in the middle, and not to strike on one side more than on the other.

The *Oesophagus* was seated at the right side of the *Aspera Arteria*, under which it passed to reach the *Ventricle*. When it was puffed up by blowing on the inside, it was enlarged to above two inches in Diameter. Being come directly over the *Bifurcation* of the *Aspera Arteria*, it was turned on the left side, and was suddenly straitned, leaving for the upper Orifice of the *Ventricle* but one Aperture about the bigness of a quill. This contracting appeared not when the *Oesophagus* and *Ventricle* were blown up; for then they made only one single Bowel. This *Ventricle* was fleshy and Musculous towards the bottom; but it was Membranous in its upper part, perhaps to enlarge and contract it self according to the need that it has for the swallowing Fishes, and for the inclosing them afterward in the *Ventricle*, where the concoction, which is begun in the *Oesophagus*, must be completed: for the greatness of the Fish which these Birds are seen to swallow is a very strange and amazing thing.

The *Ventricle* and *Oesophagus* did seem of the same Figure and size, being viewed on the outside, after that both had been strongly puffed up by the wind which was forceably made to enter therein: but the *Ventricle* was narrower, and not so capacious on the inside, by reason of the thickness of the two Membranes, whereof it was composed, which together did make the thickness of two lines. The *Pylorus* was not opposite to the Superiour Orifice, as is commonly observed, but it was as it were fixed into the middle of the *Ventricle*, leaving the lower half hanging like a Sack. This lower part was fleshy, and as it were Musculous, like a Gizzard; although

this

Duckers,

this fleshy Membrane had neither the thickness nor hardness which is ordinarily remarked in the Gizzard of Birds. And it is probable that this part was thus fleshy and Muscular, to serve to squeeze and more easily to make ascend towards the *Pylorus* that which is descended to the long and narrow bottom of the *Ventricle*, when the concoction of the aliment is there finished; the hard and Fibrous Flesh of the Gizzards being made more strongly to compress, and as it were to bruise the hard and dry grains which Birds do feed on, and not being necessary for those which do live only upon Flesh, or Fish like the *Cormorant*.

The external Membrane of the *Ventricle* was white, and appeared of two substances; its external part being Nervous and hard at top, and fleshy at bottom, as has been declared, and its internal part being quaggy, and mucous, so that it seemed that by the means of this internal part the two Membranes of the *Ventricle* were glued together. The internal Membrane, which was somewhat reddish, was Glandulous, and composed of an infinite number of small Glands a line and a half long, and about the thickness of a great pin: these little Glands did touch each other, according to their length, and were fastened, and as it were glued together, by a substance resembling their own, but somewhat less firm, and slimy. Their extremities were more firmly fastened, viz. the lower ones which proceeded from the external Membrane of the *Ventricle*, and the upper ones which did adhere each to other, and did form the internal Superficies of the *Ventricle*; so that both the ends of the Glands did render this internal Superficies like Chagrin; which doth very well represent the Velvet of the great *Ventricle* of Animals, which chew not the Cud, if it be imagined that the little long Teats which do compose this Velvet were joyned to each other, as conglomerated Glands generally are; whereas in Animals which chew the Cud, these little Teats are separated from each other, being only fastened to the internal Membrane of the great *Ventricle* by their roots. In some *Ostriches* we have found the internal Membrane of the Gizzard of a Structure wholly like to this.

In the Superiour part of the *Ventricle* towards the Orifice, there were several Worms eight or ten lines long, and about the thickness of a midling pin. They were white and transparent, and in the middle of their body there was seen as it were a blackish Vein, going from the Head to the Tail which was more pointed than the Head, which was smaller than the middle of the Body. At the bottom of the *Ventricle* there was a matter like to black blood half curdled. And it is probable that it was in effect from the blood which was fallen into this place, by reason of a blow which the Bird had received upon the head.

The *Intestines* were seven foot long. They had not those two *Appendices* which do form as it were two *Cæcums*, which *Belonius* reports to be in all Birds. We found that these sorts of *Intestines* were likewise wanting in an *Eagle* called *Haliaetos*, and some other Birds. All the *Intestines* of our *Cormorant* were of the same bigness, containing two lines diameter. They were inclosed with the *Ventricle* in an *Epiploon*, which *Pliny* avers, not to be in these Birds. This *Epiploon* had a great deal of Fat, hard like Tallow.

Tallow. On the Ventricle and Gall-Bladder there was some of this Fat fastened, and separated from the *Epiploon*, which is a thing very particular.

The Kidneys were lock'd up and separated from the other parts of the lower Belly, by the means of a Membrane which did cover them. They had an extraordinary Figure, not being divided into three Lobes as they generally are in Birds, but toothed like a Cook's Comb in their gibbous part. *Aristotle* says that Oviparous Animals, like Birds and Fish, have neither Kidneys nor Bladder, except the Sea-Tortoise. We have not yet found any Bird that wanted Kidneys or Ureters. As for the Bladder, the truth is they have no other Receptacles for their Urine, but the extremity of the *Rectum*, which is commonly more dilated in Birds than in terrestrial Animals, and having sometimes a roundness like to a Bladder, as is seen in the *Ostrich*. The *Camelion*, which is no Bird, but yet oviparous, has likewise Kidneys and Ureters which do convey its Urine into the Pouch of the *Rectum*, as in Birds.

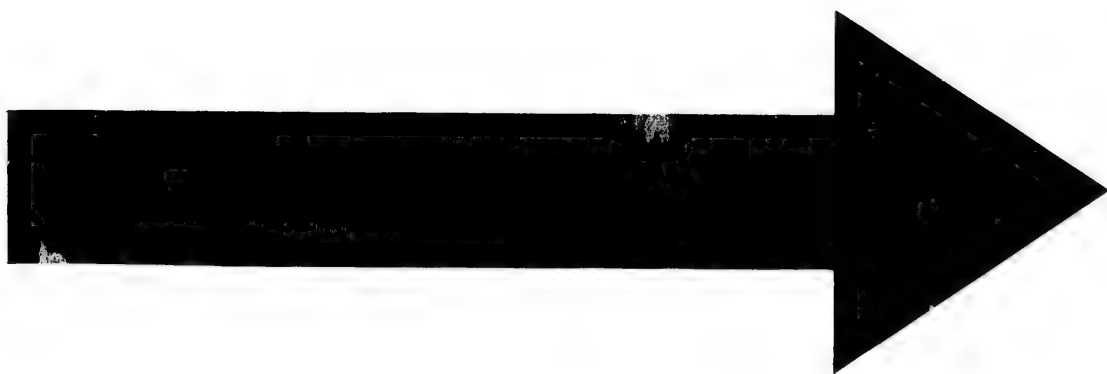
The Liver which was of a clear as Flesh-Colour, was small. It had three Lobes, two before, as is generally seen in other Birds; but the left was not half so large as the right: the third was under the left, almost of its form and size. The whole Liver was seated on the right side. The Ventricle took up the left. The Gall-Bladder was separated from the Liver, being fastened there only by its Neck, as we have found it in *Eagles*: this is likewise observed in some other Birds. The bottom of this Bladder touched the Ventricle. It was an inch in length, and three lines in breadth.

The Spleen was an inch long, a line and a half thick, of a somewhat darker Colour than the Liver. Its Figure was Semicircular. It touched the left part of the Ventricle, but was not fastened by any apparent Vessels. It was very adherent to the *Pancreas*, which reached very far, after the usual manner of Birds, into the Sinuosity which forms the first fold of the Intestines. It was of a whitish Flesh-Colour: several Vessels did fasten it to the hollow part of the Liver near the Origine of the Gall-Bladder. Its insertion into the Intestine was near that of the Bladder.

The *Aspera Arteria* had its Rings intire. At the place where it was divided, in the *Thorax*, there was a great Bony and very hard Ring. There were two Muscles or Fleshie Ligaments, which did tie the *Aspera Arteria* towards the place where it enters into the *Thorax*. These Muscles, which in the generality of Birds do knit the *Aspera Arteria* to the *Sternum*, did in this joyn it to the Bladders of the Lungs, when being divided into several tendons, these tendons became Membranous and made as it were a *Gooses Foot*.

The Heart was shut up in a *Pericardium* where there was a clear and lymphid water. It was almost round, its point being very blunt. Its Auricles were very little, especially the left: It descended not between the two Lobes of the Liver as in most Birds, the Liver being quite underneath its point.

The Tongue was very small, not exceeding three lines in length: It was double, having two points, one whereof, which was round and fleshie, did bend outwards; the other, which was Membranous and Cartilaginous, did tend toward the *Larynx*, which was hard and bony.



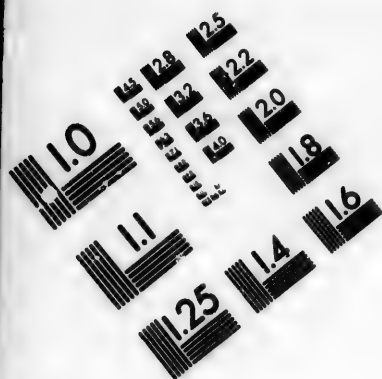


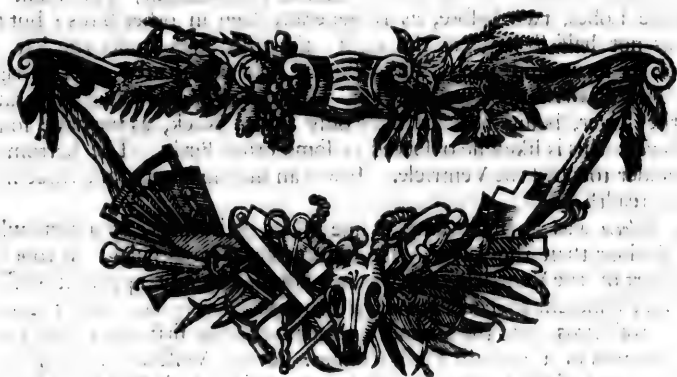
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The Eye was but half an inch Diameter. The Cornea was of a transparent and very brisk red, like to that curious Enamel which the French do call *Rouge-clair*. It is probable that this red proceeded from the extravasated blood between the two Tunicles, whereof the Cornea was composed: for these Tunicles were easily separable, and this Bird had been his several blows upon the Head. The Crystalline was small, being scarcely a line in Diameter. Its Figure was Spherical, as it ordinarily is in Fish, perhaps by reason that this Animal ought to see clear in the water where it goes to catch its Prey. It was a little depressed before.

This Bird was killed at *Seasoe*, when being brought into the Kitchen of an Inn, he there flew at the Cook, whom he bit. One of his Wings was broken, and his Skull bent in, when brought to us.



The

The Explication of the Figure of the CHAMBER of GENIT.

The lower Figure represents the different Colours of the Hair the greatness of the Head, the running of the Horns backward, and after what manner the upper Lip is cleft.

In the Upper Figure.

- A A The right Lobe of the Liver.
- B The left Lobe.
- C The little Lobe.
- D D The great Ventricle.
- E H D The Spleen which covers the left and third Ventricle in which it is cleft.
- F F A part of the Spleen which is cleft to give rise to the great Ventricle.
- G The third Ventricle covered with the Spleen.
- H The second Ventricle.
- I The Ball which was found in the third Ventricle.
- J The Vals Spermatice Prostatitis.
- K K The Branches of the Prostatitis which go to the Testicles.
- L L The Branches which go to the Neck of the Uterus.
- M M The Branches which go to the Testicles.
- N N The Branches which go to the Cornua Uteri.
- O O The Testicles.
- P P The Uterus.
- Q Q The Cornua Uteri.
- R R The Vals Spermatice Prostatitis.
- S S The Branches which go to the Testicles.
- T T The Branches which go to the Neck of the Uterus.
- U U The Branches which go to the Cornua Uteri.
- V V The Testicles.
- W W The Uterus.
- X X The Cornua Uteri.
- Y Y The Vals Spermatice Prostatitis.
- Z Z The Branches which go to the Testicles.

The Explication of the Figure of the CHAMOIS or GEMP.

THe lower Figure represents the different Colours of the Hair, the greatness of the Eyes, the turning of the Hornes backward, and after what manner the upper Lip is cleft.

In the Upper Figure.

- AA. The right Lobe of the Liuer.*
- B. The left Lobe.*
- C. The little Lobe.*
- DD. The great Ventricle.*
- EFD. The Epiploon which covers the first and third Ventricle to which it is fastened. E. Is a part of the Epiploon, which is raised to discover the great Ventricle.*
- EF. The third Ventricle covered with the Epiploon.*
- G. The second Ventricle.*
- H. The Ball which was found in the third Ventricle.*
- II. The Vasa Spermatia Præparantia.*
- KK. The Branches of the Præparantia which go to the Bladder.*
- LI. The Branches which go to the Neck of the Uterus.*
- MM. The Branches which go to the Testicles.*
- NN. The Branches which do go to the Cornua Uteri.*
- OO. The Testicles.*
- PP. The Cornua Uteri.*
- Q. The Bladder.*
- R. A Callous Apophysis at the Point of the Heart.*
- S. The Crystalline Cleft in three.*
- TT. The Oesophagus.*
- Y. The Pylorus.*

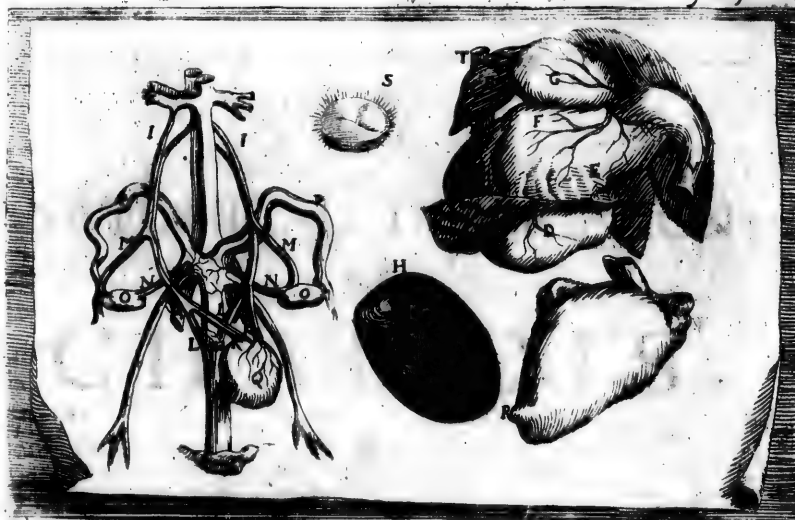
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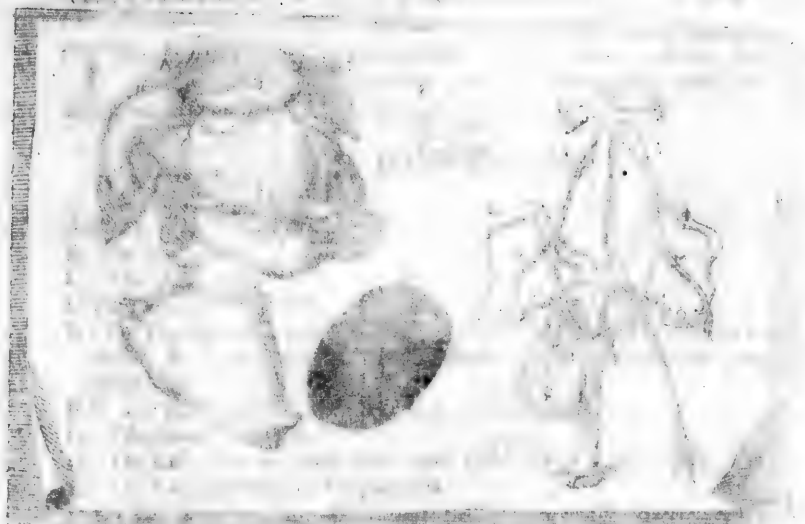
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THE
ANATOMICAL DESCRIPTION
OF A
CHAMOIS
OR
GEMP.

The *Chamois* or *Gemp* which we describe was somewhat bigger than a *Goat*. It had longer legs; the Hair in recompence was shorter. The longest, which adorned the Belly and Thighs, exceeded not four Inches and a half; on the Back it was much shorter. The Hair which did cover the Back and Flanks was of two sorts: For besides the great hair which did appear, there was a small one very short, and fine, hid underneath, about the roots of the greatest, as in the *Cassor*. The Head, Belly, and Legs had only the great Hair. At the places where this Hair was long, as at the top of the Head, on the Neck, Back, Flanks, and Belly, it was a little frizled, and waved as in *Goats*.

The Ridge of the Back, the top of the Stomach, the bottom of the Throat, Flanks, the Crown of the Head, and outside of the Ears, was of a dark *Minime* Colour. From the Ears to the Noftrills there was likewise a list of the same Colour, which surrounded the Eyes. The rest of the Hair was of a foul reddish white.

The Tail exceeded not three Inches in length. The Ears were five. On the inside they were bordered with a white Hair. The rest was smooth and of a dark Chestnut-Colour.

The

The *Eyes* were large : They had an internal Eye-lid which was drawn towards the little corner of the Eye : it was red. 'Tis perhaps upon this account that *Albertus* affirms that the *Chamois* has Red Eyes. The upper Lip was a little Cleft, in the middle, as in the *Hare*.

The *Hornes* grew on the fore-part of the brow a little above the Eyes. The Colour thereof was black. They were round and ray'd in Circles and not like a Screw. *Oppian* calls the *Chamois* *Strepsiceros*, that is to say an Animal with turned Hornes. *Aldrovandus* and *Gesner* do interpret this Equivocal word, and do upon good grounds believe that *Oppian* meant that these Horn's are turned and bent backward, and not turned like a Screw as they are in the Sheep of *Candia* which *Belonius* calls *Strepsiceros*. Indeed, the Hornes of our *Chamois* were turned backward, but because he was young they were not crooked as they are in the more Aged, in which they do grow so bending backward, and so Pointed, that it is reported that these Animals do tare their Skin in scratching themselves ; and that it sometimes happens that they do there remain so intangled, that they cannot gett them out again ; which is the reason that they are Painsht to Death. It is also reported that these hooks do serve to stay them when they do fall from the top of the Rocks on which they do love to run.

It is doubted whether the *Chamois* is the Animal which *Pliny* calls *Rupicapra*, or whether it is the *Caprea* ; for *Pliny* says that there are two kinds of wild Goats. *Jonston* thinks that the *Caprea* of *Pliny* is the *Chevreuil*. *Scaliger* is of Opinion that the *Caprea* is the *Chamois*, and that the *Chevreuil* is the *Capreolus* which *Votro* explaining *Columella* distinguishes not from *Caprea* no more than *Aldrovandus*, who says that *Caprea* is in French called *Chevreuil* : so that *Rupicapra*, according to *Scaliger*, is a common Name to *Caprea* and *Ibex*. yet it is probable that the *Rupicapra* of the Ancients is our *Chamois*, because *Pliny* says that the *Rupicapra* is different from the *Dama*, in that it has Horns turned backward, and that the *Dama*, which is another Animal than our *Dee*, has them turned forward : and he moreover reports that the *Caprea* has branching Horns, which corresponds to the *Chevreuil*. *Belonius* pretends that the *Chamois* derives its name from the Greek word *Kemas* : but the description which *Alian* gives of the *Kemas*, makes it appear very different from the *Chamois* ; for amongst other things he says that the *Kemas* has Horns turned forwards. He likewise affirms that it has the Ears garnished with a very thick Hair, which was not found in our *Chamois*, as has been already remarked. Now *Scaliger*, who reasonably complains of the little exactness which the Ancients used to describe, and rightly distinguish Animals by their proper names, has himself greatly contributed to the confusion which is at present found in the names of all the Goat-kind, of which this is one. For besides the confusion which he makes of *Caprea* with *Rupicapra*, he likewise gives *Aldrovandus* and *Gesner* occasion to think that the *Kemas*, which he takes for the *Chamois*, is in French called *Faon* ; and this Error of *Scaliger* proceeds from his not making the distinction that there is between *Kemas*, according to its common signification, and *Kemas*, according to that in which the Poets do use it : for according to the first, it in truth signifies our *Fawn* ; *Kemas* coming from *κοιμη*, which signifies to sleep, or to be lain down, because that the *Fawns* of Savage Beasts dare not to go out of the Dens and caverns

veras where they do sleep and are usually layd thus according to the second signification which is particular to the Poets, about *Chamois* reports; it signifies an Animal wholly different from the Fawn of the *Deer*, and other Animals, which in *French* are called *Fam*.

Our *Chamois* had *Incisors* only in the lower Jaw, like other Animals which chew the *Grass*. They were eight in number, and uneven; those of the middle being a great deal larger than those which were at the sides, resembling those in the *Gazelle*.

The *Feet* were cloven, and hollow underneath, and not filled with *Flesh* as in the *Gazelle*; for the flesh was drawn inwards, so that each Claw made a print in the Earth like a Horse's, and the extremity of the horn, which bore upon the ground was very sharp.

The anterior part of the *Epiploon* was fastned on the left side to the first *Ventricle*. In passing to the right side, it was joyned to the third: descending from thence it went underneath the lower part of the first, and by re-ascending behind was fastened to the bottom of this first *Ventricle*; so that this *Epiploon* was not laid on the *Intestines* as is generally is.

There was three *Ventricles*. The first, which was the greatest, was composed of two Membranes, the interior of which was Velveted, and might be easily separated from the external. The Second, which was the least, had some wrinkles raised on the inside, which did form different Figures, and composed as it were a Net. The Third, which was of a middle size, had dentilated leaves, such as are in the third *Ventricle* of *Oxen*. *Bartholinus* has found in the *Chamois* which he describes, that the two Orifices of the *Ventricle*, (for he speaks only of one) were very near each other; but in our Subject they were very distant, as the Figure demonstrates. The third *Ventricle* had a strange body, fastened to its interior Membrane. This Body was composed of a hard Membrane, in which there was Gravel inclosed. *Gesner* says that the *Chamois* uses to swallow Gravel to clear his Tongue and Throat, which are generally bedaubed with *Pituita* or *Phlegm* which takes away their Appetite. Besides this strange Body, which was naturally Clammy, there was a Ball, or glewy Bowl, but easily separable: It was of an Oval Figure, containing thirteen lines to ten. One of these ends was as it were cut, and this cut had a slight Cavity through the middle. This Ball was of a dark Olive-Colour. *Velschius* in his Treatise of the Balls which are found in the *Ventricle* of the *Chamois*, calls them *German Bezoar*. *Cardan* styles them *Corn-Eggs*, by reason perhaps that these Balls are sometimes found in the *Ventricles* of young *Corns*, which has been observed by *Pliny*. *Bartholinus* says that they are frequently found in *Denmark* in the Bellies of *Horses* and *Sheep*. He thinks that these Balls are made, either of the Hair which the *Corns* do swallow in licking themselves, or from the Wooll which the *Sheep* do eat from each other, when they do pass away the Winter in Snowie Mountains, where they can find no Grass.

The Ball which we found seemed not to be composed of Hairs, but of lig-nous Fibres: which was discovered by the inequality of these Fibres which were not of the same size, nor of an uniform Figure like as are Hairs. It must be likewise considered that these Balls are found in the Bellies of *Horses*, which are not Animals that do lick themselves, and in which they must be made

made of something else than Hair. Thus the generality of Authors, and amongst others *Camerarius* and *Gesner*, do think that these Balls are composed of the residue of the Plants which the Animals have eaten, the hardest Fibres of which are undigested; and they do say that these Fibres are of the Plant *Doronicum* which some do judge to be a kind of *Aconit*; for tho' the leaves of the *Doronicum* be tender and soft, they have some nervous Fibres, almost like *Plantain*. *Pliny* seems to confirm this Opinion, when he avers that the *Chamois* do's live on Poison as well as *Quails*: for tho' *Botanists* are not agreed upon the poyson of the *Doronicum*, and some do question whether it is poison to Men, yet they do concur that it is poison to most Beasts. It is thought that the *Chamois* does eat the *Doronicum*, to secure it self from the *Vertigo*, to which they might be subject when they do run upon the points of the high Rocks. *Velschius* asserts that these Balls are found only in the first, or Second *Ventricle*: that which we found was in the third. *Camerarius* remarks that it is toward the Month of *November* that they grow there: our Dissection was made in *December*.

All the *Intestines* together, without comprehending the *Cecum*, were forty foot long. The *Cecum* was eight inches. The *Colon* exceeded not a foot.

The *Spleen* was round and flat like a Cake; it was eight lines thick in that half which adhered to the great *Ventricle*; the other half, which was not adherent, went lessening its thickness to the end which was very thin.

The *Liver* had three Lobes, two great ones and a little one. The *Gall-Bladder* was in the middle of the right Lobe. Amongst the Animals that have no Gall, *Pliny* ranks the *Goat*, of which the *Chamois* is a Species. That which *Bartholine* Dissected had none.

The *Kidneys* were two inches long. The *Membrana Adiposa* was not joyned and fastned as usually upon the body of the Kidney, but it left a vacant space between both. The same thing has been observed by *Bartholine* in his *Chamois*. The top of the *Membrana Adiposa* of the right Kidney was fastned to the little Lobe of the Liver.

The *Cornua Uteri* were extraordinary long, and bent with several Folds and Circumvolutions. The *Testicles* were joyned to the extremity of the *Cornua*, which are properly the *Uterus* of Brutes. The *Vasa praparentia* did cast forth some Branches, not only into the Testicle and Matrix, but likewise into the Bladder. The round Ligaments took their Origine at the sides of the Matrix or *Ductus*, and did descend as is usual into the Groin where they were dilated to make that which is called the *Goose's* foot.

The *Lungs* had eight Lobes, four on the right side, three on the left, and the eighth on the inside of the duplicature of the *Mediastinum*.

The *Heart* was long and pointed. Towards the point there was a callous, white, hard, and round *Apophysis*: it proceeded out of the heart about the bigness of ones little fingers end.

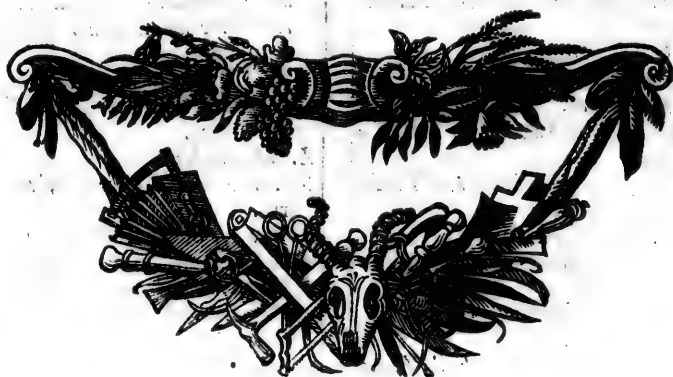
The *Brain* was large in proportion to the Body, containing two inches in breadth and three in length, comprehending the *Cerebellum*. The Anfractuosities were more and more diversified than they commonly are in Brutes. Although the *Cerebrum* was divided into the right and left, by a long cavity as is usual, yet there was no production of the *dura Mater*, to make that which is called the *Falx*: there was only a line very little elevated, which an-

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swered to the cavity of the Brain. The *Choroides* was very much dilated by the affluence of the Blood, which had been retained in the Vessels whereof it is composed. The *Glandula Pinealis* was large, containing a line in Diameter. Its Figure was rounder than ordinary.

The *Optick Nerve* did enter into the Globe of the Eye out of the *Axis*, a great deal more towards the Brow than towards the Jaw. On the inside of the Globe of the Eye, it entered through the extremity of the *Tapetum*, which was brown of Colour.

The *Crystallinus* was more convex on the outside than on the inside. It was naturally divided in three on the Superficies of its interior part. The *Membrana Arachnoidea* was very thick and hard, so that it was easily separated from the *Crystallinus*.



The Explanation of the Figure of the Porcupine and Hedgehog.

THE lower Figure represents the difference of these two Species of Animals, which are unlike not only in their size, but also in their prickles, which are all of one sort in the *Hedge-hog*, and much shorter, in proportion to the Body, than in the *Porcupine*, which has great and hard prickles on the Back and Flanks, and which on its Neck, Head, and sides of its Jaws has only long, small, and flexible Bristle.

In the Upper Figure.

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| <p>A. The Ventricle of the Porcupine.
 B. The Duodenum, which may pass for a fourth Ventricle.
 C. The great Spleen.
 D. The little Spleen, which is fastned on the Ventricle by its middle, and joynd by its lower end to the Ilium towards E.
 E F G. The Hium.
 H. The Cæcum.
 I I. The Colon.
 K. The external Ear like to that of a Man's.
 L. One of the Porcupines great Teeth, as big as the Life.
 M M. The Parastatæ.
 N N. The Testicles of the Male-Porcupine.
 O O. The Prostatæ.
 P. The Bladder.
 q q. The Ligaments which do fasten Testicles, and pass into the Thighs.
 r. The Epididymis naturally separated from the Testicle.
 Q Q. A piece of the Skin which seem'd as it were Printed on the inside by reason that it is wrinckled in small Cavities Lozenge-wise. There is likewise one of the Porcupine's prickles which was left fastned to this piece of Skin, to shew how little adherent it is, because of the smallness of its root, which penetrates not far into the Skin.
 R. One of the Quills which were upon</p> | <p>the Porcupine's Rump.
 S S. The Kidneys.
 T. The right Succenturiatus immediately fastned to the Vena Cava and Emulgens.
 U. The left Succenturiatus immediately fastned to the great Kidney, and by the means of a Vessel to the Emulgent.
 X X. The two Cornua Uteri.
 Y Y. The Testicles of the Female Porcupine.
 Z. The Bladder.
 φ φ. The broad Ligament of the Uterus.
 Γ. The left Succenturiatus cut in half.
 Δ Δ. The Testicles of the Male-Hedgehog. inclosed within the Belly, as they commonly are in the Females of other Animals.
 α α. The Epididymis.
 β β. The Parastatæ.
 γ γ. The Prostatæ.
 ε ε. Some fleshie Membranes which do serve for Cremasters.
 ξ. A Transparent Membrane.
 θ. The Bladder.
 Ω Ω. Membranes in the Male Hedgehog like the broad Ligaments of the Uterus. These Membranes are thick and very different from the Membrane ξ, which is Transparent.
 Π θ θ. The Vasa SpermatICA præparantia.
 Λ Λ. The Tongue of the Porcupine.</p> |
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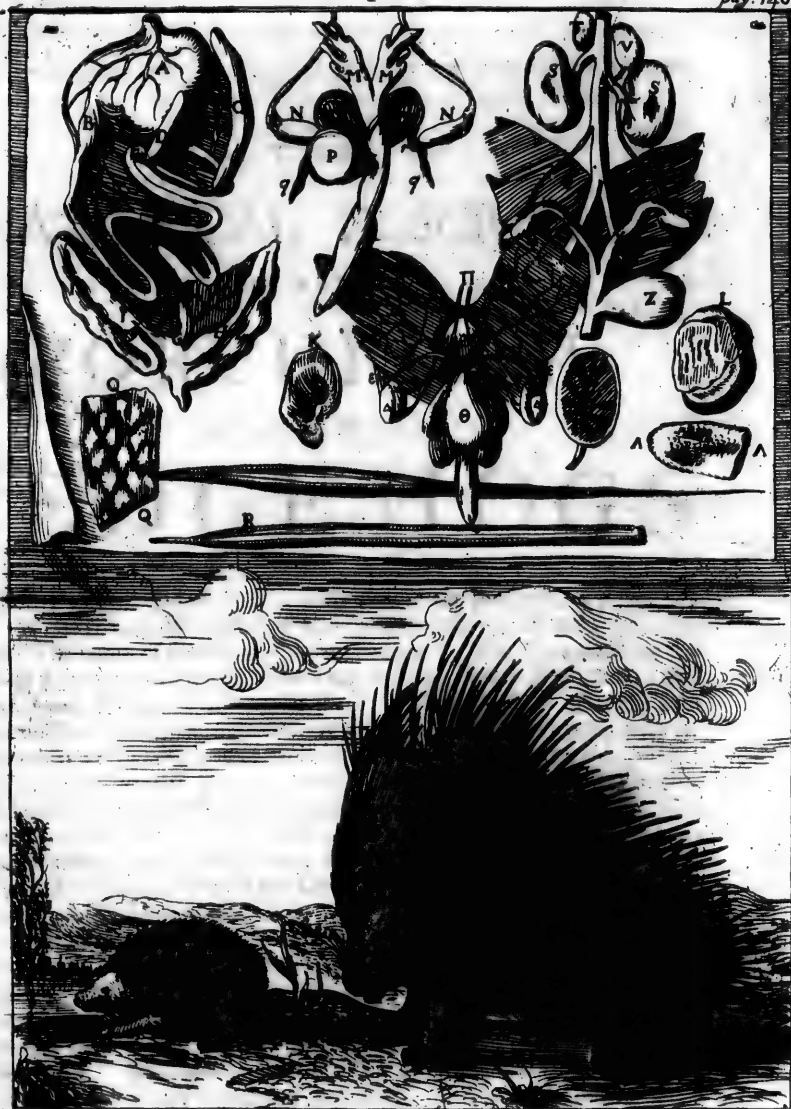
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THE
ANATOMICAL DESCRIPTION
OF SIX
PORCUPINES
AND TWO
HEDGE-HOGS.

THE *Porcupine* and *Hedge-Hog*, according to the Ancients, are Animals of one *Genus*, by reason of the Prickles wherewith they are both covered. The name of the *Genus* is *ἐχίνος*, *Echinus*. The *Porcupine* is by the Greeks and Latins called *Hystrix*. The *Hedge-hog* is by *Oppian* Stiled *βασις ἐχίνος* in Greek, *minor Echinus* in Latine, as if the whole distinction of these two Species consisted in only the difference of the size. Yet we have observed that the Animals of these two Species were likewise different in other things more essential, namely, in the Country where they do breed, in their Prickles, and in the Shape of the rest of their Body: for the *Porcupine* is bred in *Africa*, the *Hedge-hog* is common in *Europe*; the prickles of our *Hedge-hogs* were shorter in proportion to their Body than those of the *Porcupines*; and the shape, as well as the use of these prickles, was also very different, even as their Feet, Nose, and all the inward parts.

The greatest of the six *Porcupines* which we here describe, was eighteen inches from the Nose to the extremity of the hind-feet extended. They all had over the Body a Bristle or great shining Hair, resembling in its grossness Consistence, Figure, and Colour, the Bristles of a *Boar*; which has given to this Animal the Appellation of *Hystrix*, which comes from *ὤς*, *Spē* that is to say *Hogs-hair*. And indeed this Bristle did better resemble that of the *Hogg* than of the *Boar*, in that it was not intermix'd with another shorter Hair, like to the downe which garnishes the root of the Bristle of the *Boar*; but it was every where of the same length and kind. It was above three inches long all over the Body, except the top of the Neck, where it was a foot

long, and three times as big as any where else. These Bristles made as it were a tuft on the Head, of about eight inches, and mustaches about six inches long. The Bristles of this tuft was of a dark Chestnut Colour from the middle to the end.

Besides these Bristles there was likewise on the Back two sorts, of Prickles some stronger, thicker, shorter, and more pointed, the points whereof were keen, with two edges like an awl. *Claudian* puts these sorts of prickles on the head of the *Porcupine*, and says that they do supply the place of Horns: which we found not in our Subjects. The other prickles were a great deal longer and more flexible: they were a foot long, their points flattened, and weaker than the others. The shortest and strongest were white toward the root, and of a dark Chestnut Colour at the end. The longest were white at the root and end; and in the middle they were chequered with black and white. All these Hairs and prickles were hard and shining in their surface: the inside was of a Substance white and spongius.

There was likewise another kind of prickles the end of which seemed to have been cut, the rest being hollow like a quill; but that which composed this Tube was a great deal thinner than that of any quill. These Tubes or hollow Pipes exceeded a line in Diameter, and were three inches long: they were white and transparent like Pens, and rayed with little wrinkles long-ways. They were twelve in number, and laid upon the extremity of the *Coccyx*, somewhat raised at the top. Their root was very small, not exceeding the bigness of a Pin, although it was above six lines long.

Those prickles which were strongest and shortest, were easie to pluck out of the Skin, not being firmly fixed like the others: these the Animals are used to dart against the Hunters by shaking their Skin as *Dogs* do when they come out of the water. *Claudian* says elegantly that the *Porcupine* is himself the *Boy*, the *Quiver*, and the *Arrow* which he makes use of against the Hunters.

The *Fore-feet* had but four toes; the hind-ones had five, and were formed like those of a *Bear*, the great toe being outward. The whole Leg and Foot, as also the Belly, was covered with the great Bristles already mentioned, having only the sole unprovided thereof. These feet resembled not those of a *Hog*, as *Albertus* reports they do. We found likewise that the Nose of our *Porcupine* was not made like the Snout of an *Hog*, as it is represented by *Claudian*, to whom nevertheless the *Porcupine* must be well known, being born in *Egypt*, where this Animal is very common. This Nose resembled that of an *Hare*, the upper Lip being cleft: the lower was likewise pierced, and made as it were a Case, in which were shut up the two *Incisors* of the lower Jaw. These Teeth as well as those of the upper Jaw were not unlike those of the *Castor*, being very long, and situated in such a manner that the keen part of the lower ones did not meet the cutting part of the upper ones, like a pair of Pincers, as in most Animals: but these parts did pass over each other like Cissars. The *Molars* in four of our Subjects were only six in each Jaw; the fifth had eight. They were short, standing not above a line and a half out of the Jaw-bone. They were cut at the top very smooth. By their cutting it appeared that they were not intirely solid, but that the Bone was as it were folded or leaved, having amongst the folds of the Bony Substance

another

another blackish and Spongie one. These Folds were not only in the surface where they appeared, but they were through the whole Tooth, as was found after it was broken.

The *Tongue* was at its extremity covered over with several little bony Bodies like Teeth. The greatest were a line in breadth; their extremity was keen and divided by three rays or cuts, which made as it were four *Incisors*.

The *Ears* were thinly covered with a very soft Hair: they resembled those of Man. In one of our Subjects they were found different in the upper part, which was pointed as the Ears of *Satyrs* are painted.

The *Eyes* were little as in the *Hog*, not exceeding four lines from one corner to the other. The Situation of the corners of this Eye was very extraordinary, the great *Canthus* being much higher than the lesser.

Directly over the *Os Pubis* near the *Anus*, there was a tumour or swelling about the bigness of an Egg without Hair and Prickles. In the middle of this tumour, and near the *Anus*, there was a little hole less than that of the *Anus*. *Albertus* reports that the *Porcupine* has two *Anus's*, by reason perhaps of this second Aperture, which is designed for the Parts of Generation, which are not externally different in the two Sexes, almost as it is in the *Civet-Cat* and *Castor*, the *Penis* of the Male being concealed in the Pouch, which was made to come out through the hole adjoining to the *Anus*, when the Pouch was pressed.

The Skin being flead, on its internal surface appeared several wrinkles, Lozenge-wise, about two lines in bigness. The whole skin over the Back, and Flanks, was adherent to the *Musculus carnosus*, which was strong and fleshy, especially along the Back, at the place where the strong prickles are fastned. This Membranous Muscle had its Origine at the transverse and oblique *Apophyses* of the *Vertebra* of the Neck. From thence it was extended along the *Vertebra* of the Back, and inserted it self into the *Ossa innominata* being by the way fastned to the *Vertebra* of the Spine. It was very adherent, not only to the skin, as has been already declared, but likewise to the common Membrane of the Muscles. On the internal surface of this Muscle there was a great company of Nerves which were laid and interwoven like a Net. The skin was not only stirred by these Muscles, as it is in the generality of Brutes, but it had likewise four others on each side separately to remove different places of the skin, as the great skinnie Muscle is to remove the whole skin. These four Muscles proceeded from the Intercostals, where they had a large basis, which terminated on a little Tendon, like to the treble of a Lute. The Tendons of these four Muscles were inserted into the skin which covers the Ribs and Flanks.

The *Cartilago Xiphoides* was extraordinary large. The *Epiploon* which descended on the left side to the Groin, was firmly fixed in this place to the *Peritonaeum*, and did not freely flow over the Intestines as usually. In one of the Subjects it adhered to the Bladder.

The *Ventricle* was almost round, although divided into three unequal Pouches. The middle one, which was the greatest, descended lower than the others. The superiour Orifice was very strait. It was in the middle, and directly over the great Pouch. The inferiour Orifice was mightily dilated, being an inch and a half broad; so that the *Duodenum* seemed to be a fourth

fourth Ventricle joyned to three Pouches, which did represent three others: but this Intestine was contracted to make the *Jejunum*, which was very short, and the *Ileum* yet more. The *Cecum* was very large: It was seven inches long and two broad towards the *Ileum*, terminating in a point, and making in its whole length the Figure of a Sythe. It had three Ligaments correspondent to its length, which did contract it, and make Cells as in the *Colon of Man*. The Ligament that was in the bending which this Intestine made, was very large; 'twas a part of the Mesentery, but was fastened to the Intestine only by one side; the rest was loose. The *Colon* had likewise some Cells, which were not so well seen as those of the *Cecum*, although there were two Ligaments to form them. This Intestine was strait: It was forty inches long; It was folded in two, and the two parts were strongly fastned to each other throughout their whole length.

The *Liver* was suspended and hung upon the *Diaphragma*, by a very large and Membranous Ligament, which proceeded from the *Cartilago Xiphoides*, and vertically descending, was inserted from the Fissure of the Liver to the middle of its gibbous part. It had seven Lobes, four great ones, two on each side of the Fissure, and three small ones, one of which was in the middle of the Fissure, fastned by a Membrane to the *Vena Cava*; the third was underneath, between the four great ones. The two great Lobes of the left side were joyned together at their extremity by a very strong Membrane.

The *Gall-Bladder* was small, flat, and almost empty.

The *Pancreas* was very large being three inches and a half long, and six lines broad at the widest place.

The *Spleen* was different in our Subjects. There was one in which we found two Spleens. The largest, which was five inches long and ten lines broad, was fastned to the left side of the Ventricle, by the *rami Splenici* which do make the *Vas breve*: it was also fastned to the *Epiploon*. The other Spleen which was three inches in length and eight lines in breadth, was fixed to the Ventricle, without the appearance of any Vessels which did unite it. It was likewise joyned to the *Epiploon* by the upper end, and to the *Ileum* by the lower end. In the other Subjects, where it was single as is usual, it was seven inches long and ten lines broad. It was immediately fixed by its upper end to the upper part of the Ventricle, and by its hollow part to the left side of the Ventricle; by the means of the *rami Splenici*, which shot forth three branches into the Ventricle, and as many into the Spleen. The Ramifications which went to the Ventricle were three inches long: those of the Spleen were only one. In one of our Subjects the Spleen, besides the Ligaments of the *Vas breve*, and of the Membranes by which it was held to the Ventricle and *Epiploon*, had also a Ligament which did hang it to the *Diaphragma*. In all our Subjects the Spleen was of a very dark red, especially in its hollow part which regards the Ventricle, where it was almost black.

The *Kidneys* were double on each side, having a *Succenturiatus* a third part as big as the true Kidney. The true Kidney was two inches in length and one in breadth. It was very soft, not having any Cavity for the *Pelvis*. It had only on the outside a Cavity or depression in its anterior part. The *Paranechyma* of the *Succenturiatus* was very different from that of the true Kidney, being more soft; It was likewise composed of two different Substances

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viz. the one fleshy and red, as in the true Kidney; the other glandulous and whitish; these two Substances were mixed together, so that this Kidney being cut, did shew as it were several rays which went from the Circumference to the Center, almost after the same manner as it is seen in the *Cerebellum* of Man. At the Center of this Kidney there was a Cavity capable of containing a middling Bean. The *Vasa Emulgentia* made an acute Angle with the Trunks of the *Cava* and *Aorta*, having their Origins much higher than the Kidneys, which seemed drawn downwards.

The *Bladder* was very large and thick, being composed of two Coats, which included between them a substance spongy and somewhat fleshy. In one of the Subjects, as it has been already declared, all the back part of it adhered to the inferior part of the *Epiploon*, on which it was laid. The forepart, which touched the *Peritonaeum*, was less fleshy. It was loose in this place without being joyned to the *Peritonaeum*.

The *Testicles* of the Males were long and narrow, containing only four lines in breadth and an inch and half in length. The *Vasa Præparantia* were fastned to the inferior part of the *Testicle*, and did form an *Epididymis* separated from the *Testicle*. This *Epididymis* was fastned to a Ligament, which passing into the Thighs, did seem to be made to strengthen the *Testicle*, and perform the Office attributed to the round Ligament of the *Uterus*.

The *Parastata* were extraordinary great: they were two inches and a half long, and separated into three branches; and in some of our Subjects into five, like branches of *Coral*. At the end of the *Penis* there was a bone of an inch long.

In the Females the broad Ligament of the *Matrix* was strongly fastened to the Kidneys at the bastard-Ribs. The *Testicles* were of a Glandulous Substance, without any appearance of Bladders or Eggs.

The Nervous Center of the *Diaphragme* was so thin and transparent, that the Lungs were seen through. There were five principal Lobes, which were each divided into two. The Rings of the *Aspera Arteria* were not intire. The Trunk of the *Arteria Venosa* and its chief branches were of an extraordinary length. Having tied the *Azygos* in one of our Subjects, and put a small pipe underneath the Ligature, when it was blown, the *Vena Cava* swelled, beginning to swell through the *Iliaca*, by reason of the Communication of one branch of the *Azygos*, which passing beyond the *Diaphragme* went to make an *Anastomosis* with one of the branches of the *Iliac*.

The *Heart* was two inches in length from the *Basis* to the point, and fourteen lines in breadth through its middle between the point and the *Basis*: it was blunt at the end and the flesh of the left Ventricle was firm and hard. It had an Eminence which made it to appear winding like a Screw. The right *Auricle* seemed to be only a dilatation of the *Cava*. In one of the Subjects the two *Auricles* of the Heart were filled with a slimy, white, and very solid Substance, and the Ventricles with a black and congealed blood.

The *Brain* was almost like that of the *Hog*. There was no bone between the *Cerebrum* and *Cerebellum*.

The *Globe* of the *Eye* exceeded not four inches Diameter: it was almost Spherical. The *Cornea* was elevated like a demi-globe on another *Globe* formed

formed by the *Sclerotica*. The *Cryſtalline* was likewiſe almoſt ſpherical in one of the Subjects, being more convex before than behind. In this ſame Subject, the *Cryſtalline* had as it were a Kernel, its internal part being hard after the manner of a Cartilage, and not leſs tranſparent than the reſt. This Part thus hardened had not the Figure ſpherical like the whole *Cryſtalline*, but it was flat and lenticular. The optick Nerve entered at the middle of the Globe of the Eye. The *Uvea* was of a dark red; the Membrane which is applied to the bottom of the Eye, and which we do call the *Tapetum*, was whitish, and diſſeminated with ſeveral little red Spots. This whitish Colour of the *Tapetum* made the hole of the *Uvea* to appear leſs brown than the *Iris*.

The two *Hedge-hogs* which we diſſected were Male and Female, they contained eight Inches from the Snowt to the end of the hind-feet extended, which were not above two Inches. The Noſe in both was ſhort and round, better reſembling the Noſe of a *Dog*, than the Snowt of a *Swine*; ſo that they were of that Species of *Hedge-hog* called by *Machiolus Canina*, who makes two, viz. one which partakes of the *Dog*, and the other of the *Hog*; and this kind ſeems to be more common than the other, becauſe that in *Engliſh*, the *Harriſſon* is abſolutely called *Hedge-hog*, and in *Dutch*, *Een ſjere Venken*, that is to ſay, a *Hog* covered and armed with *Prickles*.

They both had the Head, Back, and Flancks covered with *Prickles*. The Noſe, Throat, Belly, and Feet were only interperſed with a very ſmall and very white Hair. *Hermolaus* ſays that the *Hedge-hog* has *Prickles* all over the Body, except on the Noſe and Paws; but we found this falſe in one of our Subjects, which had no prickls on the belly; but thoſe on the Back and ſides when it was heaped round, the Breech and Snowt approaching each other, did intirely cover the Belly.

The whole Animal was of one Colour; the Skin, Hair, and *Prickles* being of a dark yellowiſh Gray. The *Prickles* were an Inch and a half long, and very different from thoſe of the *Porcupine*; for they were ſomewhat flat-tiſh, and very like to the *Prickles* of the outward Shells of *Cheſnuts*.

The Paws were compoſed of five Toes, of which there were three great ones in the middle, and two little ones, one on each ſide. They had long, pointed and hollow Claws, making the Figure of a Pen.

The Teeth were diſpoſed in ſuch a manner, that below there was only the *Molares* and *Incifoſes*. Theſe laſt were but two, which were ſomewhat longer than the *Molares*. At the top there were no *Incifoſes*, but only two *Canini*, which left a vacancy in which the *Incifoſes* of the lower Jaw were lodged. The *Canini* which were longer than the *Incifoſes*, had each alſo a place to lye in, in the lower Jaw, between the *Canini* and *Incifoſes*, with an Interval for that purpoſe.

The Female had eight Teats, four on each ſide, diſpoſed in two ranges along the Belly and Breſt, the two higheſt being ſeated on the Pectoral Muſcle.

Having taken off the Skin, there appeared a *Muſculus Carnoſus*, which as in the *Porcupine* was extended from the *Oſſa Innominata* to the Ear and Noſe, running along the Back-bone without being faſtned thereunto; which ſhews that this Muſcle ſerves not the *Hedge-hog* for the ſhaking his Skin like the *Porcupine*, which darts his *Prickles* by this Action, but to bring its Head to its

Breech,

Breech, and to gather up the whole Body like a Ball; which the *Hedge-Hog* uses to do when it cannot save it self by flight: for being in this posture it is all over covered with its Prickles, and the *Dogs* know not how to take him without being Pricked. *Pliny* reports that if notwithstanding this Precaution, he perceives himself in danger, he let's fly his Urine, which he knows to have the quality of vitiating his Skin, and making all his Prickles to fall off, as it were to deprive the Hunters of the Principal Fruit of their Labour, which is this Skin, which the Ancients had in great esteem, by reason that it served them for Brushes to clean their Cloaths.

The Liver had seven Lobes, one of which was divided in two. The Gall-Bladder was in the middle of the two upper Lobes, which were the greatest. Its Forme was Ovale. It was eight Lines long, very full and Blew with

The *Vena Lactea* were White and very apparent in the *Mesentery*; and the Receptacle of the Chyle was great, ample, and full.

The Spleen was layd on the Ventricle, to which it was fastned, by twelve branches from the *Vas Breve*. It was long and cut like a *Cock's Comb*. The *Pancreas* to which it was fastned, had the same Forme: It differed therefrom only in Colour, the *Pancreas* being Whitish, and the Spleen of a Blackish Red.

The *Intestines* were all alike in Substance and thickness. There was no *Cacum*. They contained all together four Feet in length.

The Kidneys were an inch long and eight Lines broad. They were of an Olive Colour, the right being situated higher than the left.

The Bladder was an inch and a half long and an inch broad.

In the Male the *Testicles* were in the Belly; which, according to *Aristotle*, is peculiar to the *Hedge-Hog*, which amongst all Quadrupeds that do ingender a perfect and living Animal, is the only one whose *Testicles* are inclosed in it, as in Birds. These *Testicles* had a very large *Epididymis*, which received the *Vasa Spermatica Preparatoria* divided into four Branches, and which were separately inserted into them from the basis to the greater half of their length.

This *Epididymis* was not separate from the *Testicle*, as in the *Porcupine*, but was therto fastned, all its length. The *Vasa Spermatica Deferentia* proceeded from the top of the *Epididymis*. The *Testicle* and its Vessels were tyed and suspended by a Ligament which might passe for a *Cremaster*, because that it was a Membrane which appeared somewhat Fleshy near the *Testicle*. The rest of this Membrane was extended and enlarged after the manner of the broad Ligaments of the *Uterus*. It had a great many Vessels of which two of the chief did make a very considerable *Anastomosis*, by crossing one another in the middle. They proceeded from the *Vasa Spermatica Preparatoria*, as from their Trunk, and were distributed through this whole Membrane, extended like the Wings of a *Batt*, as in the *Uterus*; so that considering the greatness and Number of these Vessels, which were not proportionate to the quantitie of the Nourishment which the Membrane might require, it might be probably thought that the use of this Structure was, that the *Arteria Spermatica* might send to this Membrane a part of the blood which it carries to the *Testicle*, to be prepared in this great Number of branches; in which the remainder that cannot be employed to the Nourishment of the Membrane seemed to be sometime retained, and perfected by this long retention, to be inabled afterwards to reflow into the Trunk of the *Spermatick Artery*, and to

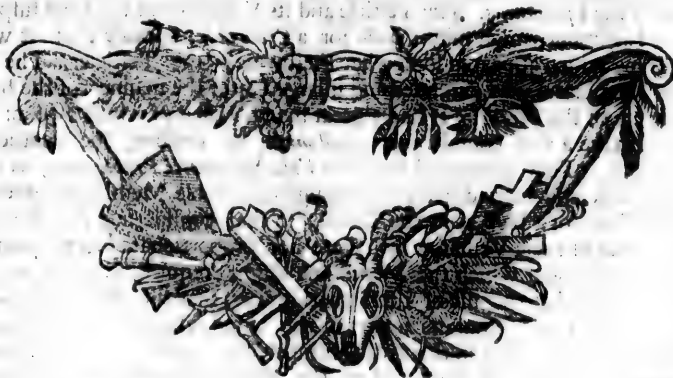
mingle with the blood which go's into the Testicle; there being nothing to oppose this reflux, of which it is necessary to suppose the liberty into all the Arteries; which upon this account are destitute of the Valves which are found in the Veins; and the compression that the motion of Respiration causes to all the Viscera, being a sufficient impulsive cause for this reflux.

On both sides of the Neck of the Bladder there were Pouches of a Substance partly Glandulous, partly Membranous. They were very Yellow: 'Twas apparently the *Parastata*. The *Prostata* were a little underneath, of an extraordinary size, even as the *Parastata*.

In the Female the *Uterus* was composed of a Neck and two Horns. The Neck was composed of two Membranes: the external was thick and Flethy, the internal was thinne, Membranous, and Nervous. The Hornes were unequal, the left being lesser than the right, in which there was a *Fistula*.

The *Lungs* had five Lobes, viz. three of a middle size at the right side, and two on the left, one of which was greater and the other lesser than all the rest. This little one, which the Cavities of the Mediastine inclosed, was forked at the end. The *Heart* was almost round. The right *Auricle* was of a Red almost black. The left was whitish.

The Globe of the Eye exceeded not two lines in diameter: it had an internal Eyelidd. Of the three Humours of the Eye there appeared only the *Crystalline*, which filled up the whole Globe, without any appearance of the *Aqueous* or *Vitreous* Humour. The *Retina* did immediately touch the *Crystalline*, and as it were stick to it on that side towards the bottom of the Eye, as the *Cornea* did cover and touch it before. The *Uvea* was all over black, without the *Tapetum*; it did not likewise make any fold on the fore-part to form the *Iris*; so that the Eye, when the lidds were open, did appear all Black.



THE

The Explanation of the Figure of two Subjoints and two other Monkeys.

The lower Figure shows how the Hands and Feet of the Ape do differ from the Hands and Feet of Man, the thumb of the Hand being small and the great Toe of the Foot very large, and the other Toes extraordinary long. Here is not described the Figure of the fourth Ape, which is the second Subjoint, because that it was wholly like to that which is here represented, except the Nails, which was longer.

In the Upper Figure.

- A. The Umbilical Veins.
- B. The two right Lobes of the Liver.
- C. The two left Lobes of the Liver.
- D. The Gall-Bladder.
- E. The Gall-Bladder.
- F. The three Ductus Hepatici.
- G. The three Ductus Hepatici.
- H. The common Bile.
- I. The common Bile.
- J. The common Bile.
- K. The common Bile.
- L. The common Bile.
- M. The common Bile.
- N. The common Bile.
- O. The common Bile.
- P. The common Bile.
- Q. The common Bile.
- R. The common Bile.
- S. The common Bile.
- T. The common Bile.
- U. The common Bile.
- V. The common Bile.
- W. The common Bile.
- X. The common Bile.
- Y. The common Bile.
- Z. The common Bile.

The Explication of the Figure of two Sapaious and two other Monkeys.

THe lower Figure shoves how the Hands and Feet of the *Ape* do differ from the Hands and Feet of Man, the thumb of the Hand being small and the great Toe of the Foot very large, and the other Toes extraordinary long. Here is not described the Figure of the fourth *Ape*, which is the second *Sapaious*, because that it was wholly like to that which is here represented, except the Nose, which was longer.

In the Upper Figure.

- A. *The Umbilical Veine.*
- B B. *The two right Lobes of the Liver.*
- C C. *The two left Lobes of the Liver.*
- D. *The fifth, Cleft and making as it were two Leaves.*
- E. *The Gall-Bladder.*
- F. *The Ductus Cyfticus.*
- G G G. *The three Ductus Hepatici.*
- 4. 5. 6. *Three Branches that come out of the first.*
- H. *The common Ductus.*
- I. *The Ventricle.*
- K. *The Spleen.*
- L. *The Pancreas.*
- M. *The Cæcum.*
- N. *The end of the Ileum.*
- O. *The beginning of the Colon.*
- P. *A Gland fastned to the lower part of the Trunk of the Cava.*
- Q Q. *Two other Glands fastned to the two Iliack Veines.*
- R R. *The Testicles.*
- S S. *The Glandulous Prostates.*
- Q. *The Bladder so turned upside down as to hide the Penis.*
- T T. *The Brain.*
- t t. *The back part of the Brain without Anfractuositys.*
- V. *The Bladder in the Natural situation, and opened to shew the Caruncle Y and the thickness of the Prostates 3. 3.*
- X X. *The Parastatæ Cyrfoides.*
- Y. *The Caruncle at the beginning of the Urethra.*
- 3 3. *The Glandulous Prostates which look but like the thickning of the Neck of the Bladder.*

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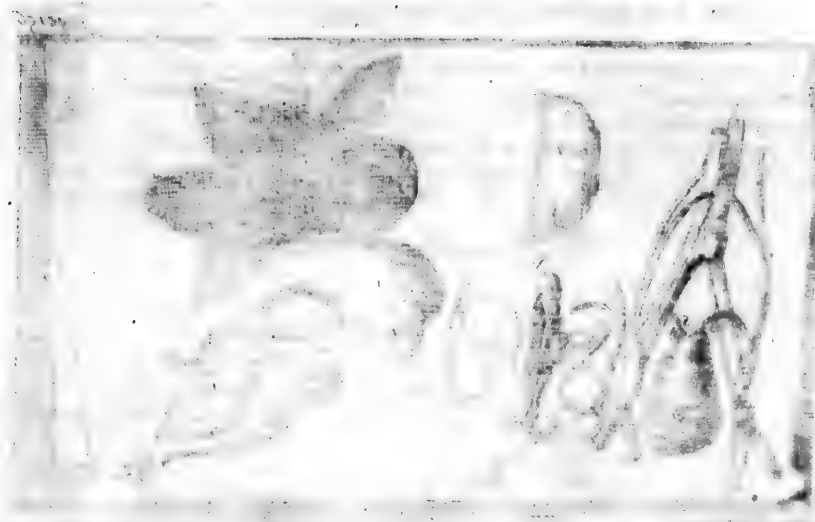
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THE
ANATOMICAL DESCRIPTION
OF TWO
SAPAJOUS
AND TWO OTHER
MONKEYS

THe Species of *Apes* are very numerous. *Rivier* reduces them under two *Genus's*; viz. those which have Tails, and those which have none. The Tail-less *Ape* is by the *Latins* simply called *Simia*. Those which have a Tail are of two Species. The *Latins* have borrowed of the *Greeks* the names which they do give them: for some are called *Cercopithecus*, from the name of the *Genus*, that is to say, Tailed *Ape*; others *Cynocephalus* that is to say, which have a head like a *Dog*, by reason of the length of their Nose. The differences of *Apes* are taken in French, principally from their size; for the great ones are simply called *Singes* or *Apes*, whether they have a Tail or no; or whether they have a long Nose like a *Dog*, or a short one; and the little *Apes* are called *Guenons* or *Monkeys*.

The four *Apes* which we describe were of the *Genus* of the *Cercopithecus*, because that they had Tails. But their smallness permits them to be ranged only under the *Genus* of *Monkeys*.

They were but fourteen inches from the Crown of the Head to the beginning of the Tail, which was twenty inches; The Arm had four inches; from the Elbow to the end of the fingers, was six inches: the Thigh four and a half; the Leg five, and the Foot four, from the Heel to the end of the longest Toe. They did likewise all agree in several other things, which are common almost to all *Apes*: viz. 1. That they had Hairs on each Eye-lid, which *Aristotle* has observed to be peculiar to the *Ape* among the *Quadrupeds*. These Hairs according to *Aristotle's* observation, were so fine that it was hard to discern them.

2. That in the lower Jaw there was a Pouch or Sack on each side into which

which these Animals used to put what they would keep. 3. That the Teeth were very white, and like Man's, except the *Canini*, which were very long in the upper Jaw, and very strait in the lower Jaw, being without Point and differing from the *Incisores*, only in their being straiter and longer. 4. That the Feet were almost like the Hands, as they generally are in other Brutes, the Toes of the Feet being as long as those of the Hands; which is not in Man, whose Toes are two thirds shorter than his Fingers. The Feet of our *Ape* did indeed more resemble the Hands of Man than their own, by reason of the conformation of the great Toe, which resembled a Thumb, being long, slender, and a great way parted from the first Finger; whereas in the Hand or Paw, the Thumb was so short, and so close to the first Finger, that it seemed almost useless. 5. That the Parts of generation in three of our Subjects, which were Males, were different from those of Man, there being no *Scrotum* in two of these Subjects, and the Testicles not appearing by reason that they were hid in the fold of the Groyn. It is true that the third, which was one of the *Sapajous*, had a *Scrotum*, but it was so shrunk, that it did not appear. 6. That the Skin stuck close on the Buttocks.

The three Males differed only in Colour of their Hair. The fourth Subject, which was a Female was of the *Cynocephali* kind; not having a flat Face like the others, but a Nose somewhat long like little *Bolonia Dogs*. Yet its long Tail did make it to be of the *Cercopitheci* kind like the others, whose differences amongst the Ancients were taken from the Colour of the Hair; the *Cercopitheci* simply called, being those which have but one Colour; and those which have several being called *Cepi*, that is to say Gardens, by reason of the diversity of Colours wherewith they seem to be flowered and Imbroidered, as *Ælian* reports *Pythagoras* to have sayd.

The first of our *Apes* was of the first species of the *Cercopitheci*, being all of one Colour, *viz.* of a Red somewhat inclining to a Green. This colour which was predominant, was only a little darker on the Back, and lighter on the Breast and Belly.

The second was of the second Species, because that besides the Greenish-Red colour of the Hair which covered the Back, the Hair which adorned the Belly, Breast, and inside of the Thighs and Arms was Gray.

The third and fourth were likewise more diversified with Colours: This Species is called *Sapajou*. These two Subjects were different, not only in colour and the various shape of their Spots, but also in the Forme of their Nose, which was long in the one, and flat in the other. The first, which was a Male, was white on the Belly, Stomach, Throat, on the inside of the Armes and Thighs, and on the Buttocks. All the Back from the *Omo-plata* to the Tail, was of a dark-Red. The Flanks, the outside of the Armes and Thighs, the Leggs and Crown of the Head were Black, and every black Hair had also little Red and White Spots, there being two Red Spots towards the end, and the half towards the root being white. On the Chin there was a white Picked Beard, an inch long. The Hair on the Back was an inch in length; about the Neck an inch and a half; it was in this place more Staring than in the rest of the Body, and made as it were a Ruffe. The Brow had a White list, on which a row of Black Hair was elevated like Eye-Brows. The *Iris* in the Eyes was of a Reddish Yellow. The *Pupilla* was very large.

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The Head was round, with a kind of a flat Face, resembling the Visage of a Man with a short and Flat Nose.

The other *Sapajou*, which was a Female, had the Nose long inclining to the *Cynocephali*. Its Hair was of three colours, *viz.* Red, Gray, and a dark Chestnut. The Belly and Breast were mixt with Red and Gray. The Armes and Leggs were of a dark Chestnut; the Back had the Chestnut and Red mixt together, so that in some places there was more Red, in others more Chestnut; which made great Spots almost as in *Cats*. It had neither the White on the Fore-head nor the Beard, as the other *Sapajou*.

The Ears of the first *Sapajou* were round and so small, that round the hole they were not extended above a line and a half, being intirely covered with the Hair. The Writers of Physiognomie, have thereon apparently Founded the Judgement which they do make of little round Ears, which they do put as a sign of a deceitful and Villanous temper, such as is the *Apes*.

Authors do not agree touching the internal parts of the *Ape*. *Aristotle*, *Pliny* and *Galen* do averr that they are wholly like to those of Man. *Albertus* do's on the contrary affirm, that as much as *Apes* are like to Man on the outside, so much are they unlike in the inside: So that, there is no Animal, as he sayes, which has the intrails so different from Mans as the *Ape*. The Observations which we have made are repugnant to both these Opinions, which are both too extream. Yet we found that our *Apes* did more resemble Man in the external parts than in the internal, and that there are more Animals which have the inward parts as like to those of Man as our *Apes*, than there are which do as much resemble Man, as our *Apes* do, in their exterior figure.

The Rings or Holes of the *Peritoneum* were as in *Dogs*; the *Epiploon* was different from that of a *Man*, in several things. 1st. It was not fastened to the Colon in so many places, having no connexion with the left part of this Intestine. 2^d. It had another Ligature which is not found in *Man*, *viz.* to the Muscles of the Abdomen by means of the *Peritoneum*, which formed a Ligament, which we have observed in the *Hinde* of Canada. 3^d. The Vessels of the *Epiploon*, which in *Man* proceed only from the *Vena Porta*, did nevertheless in one of our Subjects come from the *Cava*, having there one of the Branches of the *Hypogastrica*, which was united to the Branches of the *Porta*. 4th. In fine the whole *Epiploon* was without comparifon greater than it generally is in *Man*, because that it did not only cover all the Intestines, which is rarely seen in *Man*, whatever *Galen* says, but it even enveloped them underneath, as it do's in several other Brutes; where it is frequently seen that the *Epiploon* is larger than in *Man*, especially in Animals which do run, and leap with a great deal of Agility; as if it were so redoubled under the Intestines, to defend them, with the rest of the Bowels, against the rude joults which these Parts do receive in running. It is true that the Membranes of the *Epiploon* were intire and continued as in *Man*, and not perforated like a Net, as they are in the generality of Brutes.

The Liver which is one of the principal *Viscera*, was very different from the Liver of *Man*, having five Lobes as in a *Dog*, *viz.* two on the right side, and two on the left, and a fifth layd upon the right part of the Body of the *Pestebra*. This last was divided, making as it were two leaves. In one of our Subjects, the Substance of the Liver was speckled with several spots of a darker

ker colour than the rest, and of an Hexagonal Figure; which we have very frequently seen in Brutes, and never in *Men*. The *Bladder* was fastened to the first of the two Lobes, which were on the right side. It was an Inch long, and half an Inch broad; it had a great *Ductus*, which was immediately inserted underneath the *Pylorus*: This *Ductus* received three others, which instead of that which in *Man* is single, and which is called *Hepaticus*; these three *Ductus*'s had their Branches dispersed like Roots into all the Lobes of the Liver, so that the first had four Roots, *viz.* one in each of the three right Lobes, and one in the first of the left; the second and third *Ductus* had both their Roots in the second of the left Lobes; these Branches did run under the Tunicle of the Liver, so that they were apparent, and not hid in the *Parenchyma*, as they generally are. The *Sapagon* had this particularity in its Liver, that it was marked with a great many black Spots: which is unusual in other Livers that we have found spotted; for they are always of a lighter Colour than the rest of the Substance of the Liver: It is probable, that this blackness proceeded from the sponginess of these Parts, which being imbued with a greater abundance of Blood than the rest of the *Parenchyma*, did thereby appear more dark.

The *Ventricle* did likewise differ from a *Man*'s, its inferiour Orifice being very large and low; for it was not elevated so high as the superiour, as it is in *Man*; where it is not called inferiour by reason of its situation, but because it is thro' this Passage that the Ventricle is emptied.

The *Intestines* were hardly more like the *Intestines* of *Man* than the other Parts. In the *Sapajous* they were in all but five Foot two Inches long, and in the other two *Apes* eight; they were almost all of the same bigness; the *Leon* was in Proportion a great deal bigger than in *Man*. The *Cecum* had no *Vermiform Appendix*; it was very large, containing two Inches and a half in length, and an Inch Diameter at its beginning: It went pointing, and was fortified by three Ligaments like as the *Colon* is in *Man*, there to form little Cells: This conformation is wholly different from that of a *Man*'s *Cecum*. The *Colon* had its Cells as usual, but it was not redoubled like an *S*, as in *Man*, being quite strait. It had not the contracting which separates it from the *Rectum* in *Man*. Besides the Cells there was observed some leaves on the inside, like to those which are seen in the *Colon* of the *Ostrich*, and which we have lately remarked in the *Jejunum* of *Man*. These Leaves were transversely extended, abutting on the Ligaments which are extended along this Intestine. It was thirteen Inches long, and an Inch diameter.

The *Spleen* was seated along the Ventricle as in *Man*, but its Figure was different in one of our Subjects, being made as the Heart is represented in *Blazonry*. Its Basis contained an Inch. The *Pancreas* had only its Figure which made it to resemble that of *Man*, its connexion and insertion being wholly particular; for it was strongly fastened to the Spleen, and the insertion of its *Ductus* into the Intestine, which in *Man* is always near the *Porus biliaris*, was two Inches distant therefrom.

The *Kidneys* had a Figure and Situation not less extraordinary. They were round and flat; their situation was more unequal than in *Man*, the right being much lower, in respect of the left, *viz.* half its bigness. The Gland called *Capsula Atrabiliaria* was very visible, by reason that the Kidney was without Fat. This Gland was white, and the Kidney of a bright Red; its Figure was Triangular.

Aristotle

Aristotle says, that the generative Parts of the *Ape* do resemble those of the *Dog*. In our Subjects we found that they were different therefrom, as well as from those of Man; for in the Males, the *Penis* had no Bones, as it has in the *Dog*; and the Testicles, which in some of our Subjects were hid in the Groyn, without any *Scrotum*, as has been say'd, had a very particular Figure, being long and strait, and but one line in breadth and eight in length. In one of the *Sapajous* they were found of a Figure quite contrary, and almost as remote from the Figure of those of Man, being perfectly round; they were shut up in a *Scrotum*, which joyned them close up to the root of the *Penis*. The glandulous *Prostate* were small; the *Parastate Cyrsoides* were in requital very large; they contained an Inch in length; their breadth was unequal, being four Lines towards the Neck of the Bladder, and a Line and a half at the other end, differing herein from those of Man, who has them slenderest near the Neck of the Bladder. They were composed of several little baggs, which opened into one another: the Caruncle of the *Urethra* was small, but very like to that of Man.

The generative Parts of the Female had also a great many things which rendered them different from those of *Bitches*, herein resembling those of *Women*; there were some of them likewise which were as in *Bitches*, and after another manner than in *Woman*; for the exterior Orifice was round and strait, as in *Bitches*, and the generality of other Brutes, and had neither *Nympha* nor *Caruncula*. The Neck of the Bladder had its hole otherwise than in *Woman*, being very far in the Neck of the *Matrix*, viz. towards the middle, at the place where its roughness began, which were seen only towards the extremity of the *Ductus* near the Internal Orifice. The Trunks of the *Matrix* were also different from those of *Women*, and resembling those of *Brutes* in that they were proportionably longer, and more redoubled by various turnings. The *Clitoris* had something more conformable to that which is seen in other Brutes that have it, than in that of *Women*, being proportionably greater, and more visible than it is in *Women*. It was composed of two Nervous and Spongy Ligaments, which proceeding from the lower part of the *Os Pubis*, and obliquely advancing to the sides of these Bones, did unite to forme a third Body, which was ten lines in length. It was formed by uniting of the two first, which a very strong Membrane joyned together, going from one of the Ligaments to the other, besides a hard and Nervous Membrane which invloped them. They terminated at a Gland like to that of the *Penis* of the Male. The little Muscles, which were fastned to these Ligaments, proceeded as usual from the tuberosities of the *Ischi-um*. These Ligaments were of Substance so thin and Spongy, that the wind penetrated, and made them easily to swell, when blown into the Network of the Veins and Arteries which is in this place. This Network was visible in this Subject, being composed of larger Vessels than they proportionably are in *Women*. It was situated as usually under the second pair of Muscles of the *Clitoris*. Its Figure was Pyramidal, ending from a very large *Basis* in a point, which run along the third Ligament to its extremity towards the Gland.

The rest of the Parts of Generation were like to those of Women. The Neck of the Bladder had its Muscles as in Women: For there were a great Number of fleshy Fibres, which proceeding from the *Sphincter* of the *Anus*, were fastned to the sides of the Neck of the *Uterus*, and other such like Fibres which did come from the *Sphincter* of the Bladder to insert themselves at the same place. The body of the *Uterus*, its Membranes, internal Orifice, its Ligaments as well the Round as Broad, and all its Vessels had a conformation intirely like to that, which these same parts have in Women. The Testicles, which were ten lines long and two broad, were as in Women, composed of a great Number of small Bladders, and fastned near the Membranes which are at the extremity of the *Tuba* and which is called their Fringe.

The Duggs resembled those of Women, as well in what respects their situation, which was on the *Musculi Pectorales*, as in what appertains to their composition, which consisted of a Glandulous Body, and a Tear.

At the place where the *Vena Cava* is divided to produce the two *Iliacks*, there was a Gland of the Figure and bigness of a middling Olive, containing five lines in length and three in breadth, Black on the outside, and much more on the inside. It was moistned with a Lymphatick Humour, wherewith its Spongy Substance was filled. In this same Subject, which was one of the two first *Monkeys*, there were two other such like Glands, but smaller, towards the Origine of the *Cruvats*, one on each side.

At the opening of the Breast, there was found a great abundance of Water dispersed over its whole capacity. The *Thymus* was very large. The *Lungs* had seven Lobes, three on the right side, and as many on the left: the seventh was in the Cavity of the *Mediastine*, as in the generality of Brutes. This again makes a Notable difference between the internal parts of the *Ape* and those of Man, whose *Lungs* have generally at the most but five Lobes, oftener but four, and sometimes but two. *Vesalius* affirms that he never saw in Man this fifth Lobe, which he reports to be in *Apes*, supposing that they have but five. This great Number of Lobes of the *Lungs* clearly evinceth that Anatomists have no reason to say that Brutes have the *Lungs* divided into more Lobes than Man, by reason that they have the Face and Breast turned towards the Earth, seeing that the *Ape* has generally the Face and Breast like a Man.

The *Heart* was a great deal more Pointed than it usually is in Man: which is likewise a Character of Brutes. Yet in the interior Superficies of its Ventracles it had that great Number of Fibres and fleshy Columns which are seen in Man.

The *Uvula*, which is in no other Brutes, was found in our *Ape* wholly resembling that of Man.

The *Cranium* had a Figure very conformable to a Mans, being round and somewhat flat at the sides, and wanting that Triangular Bone which separates the *Cerebrum* from the *Cerebellum* in most Brutes.

The *Brain* was large in proportion to the Body. It weighed two ounces and a half. The *Dura Mater* entred very far to form the *Fals*. The Anfractuosities of the external part of the Brain were very like those of Man in the Anterior part; but in the hinder part towards the *Cerebellum*, there was hardly

hardly any : They in requital were much deeper in proportion. The *Apo-
physes*, which are called *Mamillares*, which are great Nerves that do serve to
the Smelling, were not soft as in Man, but hard and Membranous. The
Optick Nerves were also of a Substance harder and firmer than ordinary.
The *Glandula Pituitalis* was of a Conical figure, and its point was turned to-
wards the hinder part of the Head.

There was no *Rete mirabile* : for the *Carotides* being entred into the Brain,
went by one single Trunk on each side of the edge of the seat of the *Sphenoides*
to pierce the *Dura mater*, and to be distributed as usually into the *Basis* of the
Brain.

To finish the Description as well of the external as internal parts of the
Apes which we dissected, by comparing them with those of Man, we have
made an accurate search after all the Muscles of these Animals, which we
found for the most part agreeable to those of Man : So that we do here relate
only those things which we found particular in our Subjects.

The Muscles of the Face, in that which participated of the *Cynocephalus*
had a great deal of similitude with those of *Dogs* ; and in the *Apes*, which had
the Face flat like Man, it had nevertheless some Muscles like to those of
Brutes : as amongst others the *Masseter's* and *Crotaphita*, which were a great-
deal larger in proportion than in Man,

The Muscles of the *Os Hyoides*, *Tongue*, *Larynx* and *Pharynx*, which do most
serve to articulate a word, were wholly like to those of Man, and a great deal
more than those of the Hand ; which nevertheless the *Ape*, which speaks
not, uses almost with as much perfection as Man : which Demonstrates
that speech is an Action more peculiar to Man, and which more distinguish-
es him from the Brutes than the Hand ; which *Anaxagoras*, *Aristotle* and
Galen have thought to be the Organ which Nature has given to Man as to
the wisest of all Animals, for want perhaps of making this Reflection. For
the *Ape* is found provided by Nature of all these Marvellous Organs of speech
with so much exactness, that the very three small Muscles which do take
their rise from the *Apophysis Styloides*, are not wanting, altho this *Apo-
physis* be extremely small. This particularitie do's likewise shew that there
is no reason to think that Agents do performe such and such Actions, be-
cause they are found with Organs proper thereunto : For according to these
Philosophers *Apes* should speake, seeing that they have the Instruments ne-
cessary for speech.

In the Muscles of the Head and Neck there was nothing particular but the
Flexors of the Head, which in Man are inserted into the *Apophysis Mastoides*.
For they were fastned to the lateral and hinder part of the *Os Occipitis*, because
that the Head of the *Ape* has no *Apophysis Mastoides*. Amongst the Muscles
of the Armes there was only the *Palmaris* that had any thing remarkable. It
was extraordinary large. The great *Serratus*, which in Man takes its rise
only from the *Omoplate*, did in our Subjects proceed likewise from the fourth,
fifth, and sixth *Vertebra* of the Neck.

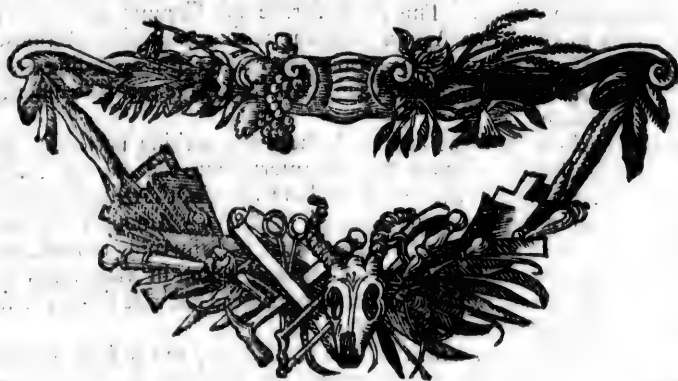
The *Musculus Rectus*, which in Man reaches only to the *Basis* of the *Ster-
num*, did ascend to the top, passing under the *Pectoralis* and little *Serratus*.
It was fleshy only to the half of the *Sternum*, the rest being but a meer
Tendon.

In the Thigh that of the *Quadrigenini* (which do serve to throw out the Thigh) called *Pyriformis*, was a great deal smaller than in Man; and in stead of taking its rise from the lower and external part of the *Os Sacrum*, it proceeded from the *Isthium* near the *Cavitas Cocyloide*. The Muscles of the Buttocks had a Figure different from those of Man, being shorter, by reason that the *Ossa Iliam Apes* are much straiter than in Man. On the *Musculi Psoa* there were two other little Muscles, which are not found in Man. Every of these Muscles having the same Origine as the *Psoa*, did come by a long Tendon to insert it self into the upper and inward part of the *Os Pubis*.

Amongst the Muscles of the Leg, that of its *Flexores*, which is called *Biceps*, had not a double Origine as in Man. It proceeded intire from the knob of the *Isthium*, and was inserted into the upper part of the *Perona*. This single Head was in requital very thick and strong.

The great Toe had Muscles like to those of a Mans Thumb, even as it has the Action thereof: Which is not in the Foot of Man, where the great Toe has Muscles very different from those of his Thumb, because that the Actions of these two parts are in Man very different.

To the History of the Muscles of the *Ape* might be added the Description of the Pouch, which they have in their Mouth. It was composed of Membranes and Glands, and of a great many Musculous and Carnous Fibres. Its situation was on the out side of each Jaw, reaching obliquely from the middle of the Jaw to the under part of its Angle, passing under a part of the Muscle called *Latissimus*. It was an inch and a half long, and almost as broad towards its bottom. It opened into the Mouth between the bottom of the Jaw and the bottom of the Gumme. 'Tis into this Pouch that *Apes* use to put what they would keep; and it is probable that the Musculous, Fibres which it has, do serve to shut and open it, to receive and put out what these Animals do there lay up in Reserve.



THE

In the 7th Figure.

[Illegible text]

The Explication of the Stag of Canada, and Hinde of Sardinia.

THe lower Figure represents the Disproportion which is between the *Stag* and *Hinde*, the *Stagg* being almost as big again as the *Hinde*. It discovers likewise how the Hornes of the *Stagg* is covered with a Skin, and how the *Hinde* has the Back and Flanks marked with several spots of different shapes.

In the Upper Figure.

A A. *The Liver.*

B. *The great Ventricle of the Stag.*

C. *The little Ventricle.*

D. *The extremity of the Vasa Spermatice Præparantia*

E. *The Testicle it self.*

F. *The Vasa Spermatice Deferentia.*

G H H. *The Epididymis.*

I. *The Vterus.*

K K. *The Cornua Vteri.*

• L L. *The round Ligaments of the Uterus.*

M. *The Bladder.*

N. *One of the Cornua Uteri opened to discover the two leaves O O. which it has on the Inside.*

P P. *The Carotides opened to shew the transverse lines which it has on the inside.*

Q Q. *The Jugular opened to shew the six rows of Valves which it has, viz. four marked R, where they are three in a row; and two marked SS, where they are two and two.*

T T. *A piece of the Jugular represented at large, the more distinctly to discover a row of three Valves marked V V V.*

X Y Z Ω. *The end of one of the Brow-Antlers of the Stag.*

X. *Part of the Horn with the Skin taken off, to expose to view Grouves wherewith the Hornes of the Stag are ordinarily hollowed, to make roome for the Vessels in the Skin which covers them.*

Y, *The peice of Skin which is cut away, and on the inside of which is represented the Vessells in it.*

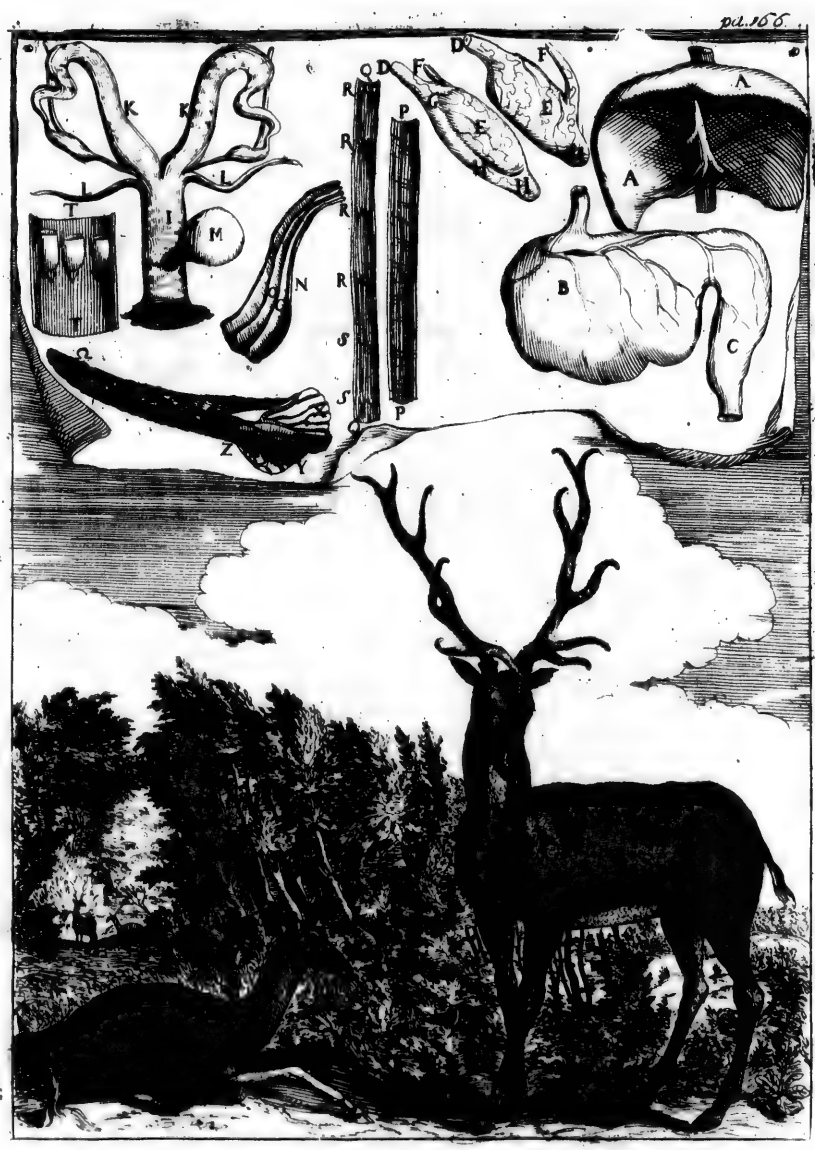
Z Ω. *The rest of the Brow-Antler covered with the Velvet Skin.*

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THE
ANATOMICAL DESCRIPTION
OF A
STAG OF CANADA
AND
HINDE OF SARDINIA

THe Stag was very large, being four foot from the top of the back to the Ground. Its Hornes were three foot long, and the *Brow-Antlers* a foot; there were six on each Horn, which is the greatest number that Stags do carry, according to *Aristotle* and *Pliny*; which nevertheless is not true in this Country, where are found Stags that have them to Twenty two.

The whole Hornes were covered with a very hard Skin, and garnisht with a very thick and short hair, of the same Colour as that which covered the Body: it was turned in several places. *Pliny* very improperly calls this Hair, Feathers soft as Downe. This whole Skin had a great many Veins and Arteries filled with plenty of Bloud, which swelled them on the inside next the Horne, which was all furrowed to give place to the Vessels, after the same manner as the *Cranium* or Skull is fluted on the inside, according to the distribution of the Vessels of the *Dura Mater*. *Gesner* was of opinion that the furrows which are seen in the surface of the Horns of the Stag, are made by Wormes which do ingender there in the Summer, and which do Eat it; which is altogether improbable. *Pliny* had not also well examined the Nature of the Hornes of the Stag, when he says that they were like the Plant *Fernula* and the *Reed*: For the Stalks of these Plants, which are either hollow, or Pithy, do ill expresse the Soliditie which is peculiar to the Hornes of the Stag.

Democritus has better Philosophized on the Generation of these Hornes; for he affirms that in the Stag, because he abounds with Bloud and grows
very

very Fatt at the beginning of Summer, Nature consumes a part of the Nourishment where-with it is overcharged, by sending it thro some Vessels, which it has in a great Number and of a considerable thicknesse, to the place where the Hornes do grow. And indeed, it is a very surprizing thing to see the abundance of blood which we found between the Hornes and the Skin which covered them, when by Fleeing off this Skin, the Tunicks of the Veins being very fine and small were broke in sunder,

This Observation made us to reflect upon the different Generation of the Hornes of Animals, which being of two Natures, namely some hollow, and others solid, have likewise two way's of growing: For those which are solid, and without Cavities, like those of the *Stagg*, are immediately fastned to the *Os Frontis* from which they do seem to grow, this Bone being a great deal more rare and Spongius than in other Animals, as *Democritus* has observed. But if the first Origine or Germination of the Hornes of the *Stagg* do's proceed from any substance which comes out of the Bone, its increase depends chiefly on the Skin which covers it, and which affords it a great quantitie of Nourishment, thro the great number of Vessels contained in it.

Hollow Hornes like those *Oxen* are ingendered and do grow after a quite different manner: for they are not immediately fastned to the Skull, but they have their Cavities filled by a Bone which is an Appendix of the *Os Frontis*; and this Appendix even as the rest of the Skull is covered with the *Pericranium* by the means of which these Hornes do joyn to the Skull, and are ingendered and do grow from what they receive from the Vessels of the *Pericranium*: for on the *Pericranium* which fastens the Appendix of the *Os Frontis* there is a Crest, apparently made by the Transudation of a matter contained in the Vessels of this Membrane, which we found in the Cavity of the Hornes of the *Gazellas* incomparably greater, fuller of Blood, and more numerous, than they are in the rest of the *Pericranium* which covers the other Bones of the Head. So that it must be understood that even as Solid Hornes do take their Nourishment and increase by their external Superficies, those which are hollow do take it at the internal: for when the first Crust begins to be hardened on the Production of the *Pericranium*, which covers the Pointed Appendices of the *Os Frontis*, by hardning almost after the manner as Nails do harden at the ends of the Fingers; between this first Crust and the *Pericranium* there is ingendered another which glues it selfe to the former and thrusts it forward; and thus there is successively ingendered several Crusts one upon another, almost after the same manner as Snail-shells, and Oyster-shells are ingendered and composed of several *Lamina* or Plates glued to each other. This is the reason that hollow Hornes are generally wrinkled and ruffled like shells, and that they are easily separated into several Leaves.

Aristotle has given some Idea of this manner of the Generation of hollow Hornes, in saying that there enters into their Cavity something hard, which springs from the Skull; which must be understood of the Bone which enters into the Cavity of the Hornes: But he speaks not of the *Pericranium* to which the Horne is immediately fastned, and from whence it is probable that it takes its Origine and Nourishment.

The Generation of hollow Hornes is likewise different from that of solid ones,

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ones, by the different quality of the matter, which is more aqueous in hollow Hornes, and more Terrestrial in solid ones. Hollow Hornes do easily soften before the Fire, as not having their Concretion by the Exiccation and Consumption of the Aqueous parts, but by the Coagulation of a Matter which hath not a consistence so firm, without the cold which does harden it: and solid Hornes are of the Nature of the Bones from which they do proceed, being of a Terrestrial matter, which, according to *Aristotle* and *Pliny*, is hardened on the Head of *Staggs* by the heat of the Sun: *Aristotle* makes also a remark which demonstrates that the matter of *Staggs*-Hornes is Terrene, dry and of the Nature of Stone; for he says that there has been sometimes *Staggs* taken, on whose Hornes there was found *Ivie*, which had there taken Root as it do's on Stones: and Naturalists have observed that the *Ivie* do's frequently grow in places where *Staggs* Hornes are Buried. This conjecture may be confirmed by the consideration of that excrescence which is peculiar to the *Stagg*, called *Lachryma Cervi*; which comes out, as it is said, from the great *Cantons* or Corner of the Eye, being strongly fastened to the Bone, out of which it grows; according to *Scaliger*: for this excrescence is so like a Stone, that some do think it really is one, and that it grows not out of the *Stagg*, being very far from giving credit to what Authors report of its Generation, viz. that it comes out of the Corner of the Eye of the *Stagg*, when to cure it selfe of the Wormes which it has in its *Intestines*, it eats Serpents, and plunges into the Water up to the very Eyes. The Bone which is found at the *Basis* of the *Staggs* Heart, is likewise a Sign that this Animal do's exceedingly abound in a juice capable of being easily converted into a Bone and as it were Stoney Nature.

The *Intestines* being taken all together, did measure Ninety six foot in length. The smallest contained sixty six foot, and the great ones without the *Cacum* twenty. The *Cacum* was one foot ten inches in length and six inches in breadth towards its *Basis*. It went lessening towards its Point as usual. This extraordinary length of the *Intestines*, which is proportionable to the greatness of the Ventricle in Animals which do live on Grass, is not found in those which are fed with flesh; because that Grass, being not so easy to be changed into Bloud, and this Nourishment affording it less matter than flesh, it was necessary to have the Ventricles thus large, to contain a great quantity of Grass, and that the *Intestines* should be proportionably long, to make room for the Natural heat to operate a long time on the Nourishment retained and conducted thro long Turnings.

There were two *Ventricles*, a greater and a smaller, which seemed to be the *Duodenum* enlarged. The great *Ventricle* being blown was five foot round. It was composed of several other *Ventricles* heaped in one, by reason of four or five bunches which it had connected together by a Membrane which did joyn, and make them to forme to this *Ventricle* several Cells. On this Membrane there was another which did cover and lock up the whole *Ventricle*. This Membrane was fastened behind to the *Ventricle*; Before it was joyned to it only at top, the rest being wholly separated, and greatly extended, by a great deal of wind which it shut up with the *Ventricle* and *Intestines*, which it also covered like an *Epiplon*. The upper part which covered the *Ventricles* was thin, and transparent, without Fat, Glands, or apparent

Vessels: the part which descended to inclose the *Intestines* had some Vessels and Fat, but in a very little quantity.

The *Spleen* was round, thin, and wholly adherent to the great Ventricle. It was six inches Diameter. The Vessels which do make the *Vas Breve* were utterly imperceptible. The Gibbous and upper part was fastned to the *Diaphragme* by three strong Ligaments.

The *Liver* had but one Lobe, and was only Cleft before, and quite whole within. The right side was somewhat more extended than the left, and made a point towards the Kidney. There was no Gall-Bladder.

The *Kidney* was very large, being five inches long and three broad. There was no *Ren Succenturiatus*.

The *Penis* had no bone. The proper Membrane of the Testicle was immediately fastened to the Glandulous Substance, so that it was absolutely inseparable therefrom, and more than usual in other Animals. Over this Membrane were an infinite number of Blood-Vessels, some whereof were strait and as big as a Bodkin; others were undulated, and as it were frizled, very small, about the bigness of a Pin. The Glandulous Substance of the body of the Testicle was Yellow; that of the *Epididymis* of a pale livid Red. The Uniting of the *Vasa Preparantia* was wreathed and confounded, and made a Tube about the bigness of ones Finger, which produced the *Epididymis*, which covered and imbraced the top of the body of the Testicle even as the Cup of an *Acorne*. This part resembling an *Acorne* did produce a body about the thickness of ones Finger, which descended along the body of the Testicle, being there fastened, and made towards the bottom a kind of a Teat, from whence it returned along the side opposite to that by which it descended, and formed the *Vas Deferens*, which was about the thickness of a *Swans* quill.

The *Lungs* had seven Lobes, four on the right side and three on the left. The *Heart* was very large, almost round and soft, because that the Ventracles were very large. There was a Bone as usually in *Sraggs*.

TO the Description of the *Srag* we do joyn that of the *Hinde*, to discover wherein these two Animals did agree, and in what they were unlike besides the difference of the Sex.

The highth of this *Hinde* was two foot eight inches, from the back to the Ground. The Neck was a foot long. The hind-legg, from the Knee to the end of the foot, was two foot, and to the Heel one foot.

The *Hair* was of four Colours, *viz.* Fallow, White, Black and Gray. There was some white under the Belly and on the inside of the Thighs and Leggs: On the Back it was of a dark fallow: On the Flanks, of an *Isabella-fallow*: Both the one and the other on the Trunk of the Body was marked with White Spots of different figures: along the Back there were two rows in a direct Line; the rest was confusedly Speckled. Along the Flanks there was on each side a White line. The Neck and Head were Gray. The Tail all White underneath, and Black at Top, the Hair being six inches long.

The *Epiploon* was fastened to the *Peritonaeum* directly over the Navel, and enveloped the *Intestines* underneath. It was composed of very thin Membranes, and small Vessels without Fat: It was double.

The

The *Liver* was small, and like to that of the *Stagg*, in that it was not separated into several Lobes, having only the fissure, which is generally at top towards the middle, and an other underneath inclining to the right side. There was not also any *Gall-Bladder*.

The four *Ventricles* were better distinguished and separated each from other than they were in the *Stagg*, where there was distinctly seen but two. The first and greatest *Ventricle* had on the inside a Membrane easily separable from that of the outside, as in the *Gazella*. This internal Membrane was rough by an infinite number of Asperities or Teats, as is generally seen in Animals which chew the Cud. All this great *Ventricle* was contracted in several places, and separated in different Pouches as in the *Stagg*: it was filled with Grass, amongst which there was found several pieces of Skin, of shoe-Soles about the bigness of a Crown-piece, some pieces of Lead about the bigness of ones Nail, which seemed worn and fretted, and some Fragments of slate. This may make one to think that these sorts of Animals do hastily gather their Food in the Fields, and that they do wait to cull it leisurely when they Chew it. The second, third, and fourth *Ventricle* were not different from those of *Sheep*.

The *Intestines* were very long as in the *Stagg*, but less in proportion. They measured in all forty foot. There were two sorts: the first which made a bout a quarter, were Grayish, and plaited in Folds six inches long: the others were of a dark Red, and folded very small in Cells. The *Mesentery* was composed of very fine Membranes.

The *Spleen* was covered with a hard, thick and whiteish Membrane: Its figure was round; it was like that of the *Stagg*, strongly knitt to the *Ventricle* and *Diaphragme*.

The *Cornua Uteri* were long and bent into several Anfractuosities. Their extremity was applyed to the Testicle which was small, on the inside of each of these Horns there were two folds of the internal Membrane, which did forme some leaves ranged according to the length of the Hornes, almost after the same manner as is seen in the third and fourth *Ventricle* of Animals which chew the Cudd.

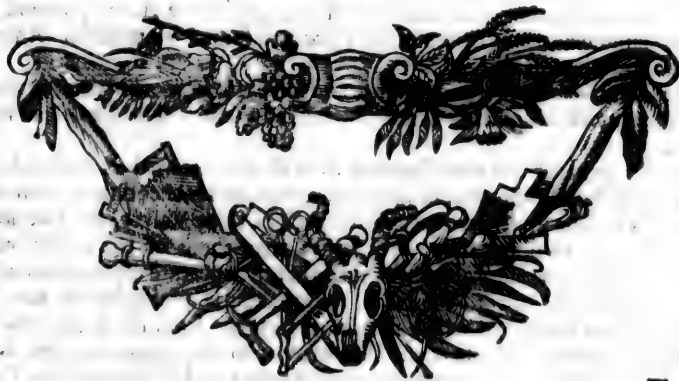
The *Heart* was extraordinary large and soft: Its *Ventricles* were extended by a quantity of coagulated blood which filled them. The *Lungs* had seven Lobes.

The Trunks of the two *Jugulars*, as well the internal as external, had each sixteen Valves disposed in six rows, about two inches distant from each other. The four upper rows consisted each of three Valves; the two lower ones had only two, but they were larger than those of the upper rows. The disposition of these Valves was such, that the aperture of the Sacks which they did form was toward the Head, to stop, as it is probable, the too great impetuositie of the Blood which falls in its returne from the Brain into the Axillary Branches. Those of the Moderns who are ignorant what is the Motion of the blood in the Veines, have attributed this use to all the Valves of these Vesseles, the situation of which is found to be contrary to the Motion and course of the Blood, after the Manner as they understand it, and favourable to the course which it effectively has for the Circulation, that is to say for its return towards the Heart. *Bartholinus* has remarkt two Valves in

one of the *Jugulars*. *Riolanus*, who first found out these two Valves affirms that they are never found but in the internal *Jugular*, although we have always found them in the external as well as Internal: But this situation of the Valves contrary to the Motion of the Blood towards the Heart, has as yet been seen only by *Amatus Lusitanus*, who has observed some of this Nature at the beginning of the *Azygos*, and which he thought to serve to hinder the Blood of the *Azygos* from returning into the Trunk of the *Cava*; but this Conformation is extraordinary, whatever this Author says, who avers himself to have seen it a thousand times; because that all Anatomists, with an unanimous consent, do testify and avow to have seen the contrary, and never to have found Valves in the Veins, whose Situation favoured not the Motion of the Blood towards the Heart.

The *Carotides* having been opened long-ways, it was observed that they had several Rays like transverse Cutts, which interrupted the continuities of the Fibres, which are according to the length of the internal Membrane of this Artery: which appeared to be made to knit together these Fibres, and to fortifie them even as it is seen in the Fibres of the right Muscle of the Belly, which are so interrupted by the transverse lines, that they are called *Emervations*. It was searcht whether the same thing could be found in the *Crural* Artery, but it was smooth and even, and had not these Cutts.

The *Globe* of the Eye was an inch and a half in Diameter. The *Crystalline* was more convex behind than before.



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The Explication of the Figure of the Pintado

THe *Pintado* which is represented in the lower Figure, has no Tuft at the root of the Beak, like that whose Head is represented in the upper Figure. As to other particulars, the Ten which we describe, had all that is remarkable in this *viz.* the Tail turned downwards as it is in *Partridges*, the Neck and Leggs longer than *Partridges* are; the Feet provided with Membranes after the manner of Water-Fowl; the Head covered with a Casque; the top of the Beak garnished with two Appendices; and the whole Plumage black, or dark-gray, Speckled with white Spotts.

In the Upper Figure.

- A B. One of the Feathers of the Wing. A is the part of the Wing which is uncovered. B is that which is covered by another Feather.
- C D. One of the Feathers of the Belly. C is the part of the Feather which covers the Down marked D.
- E F G. The Head almost as big as the life. E, the Tuft which grows out at the root at the Beak. F. the Casque or Bonnet.
- G The fleshy Beards.
- g. The hole of the Ear.
- H H. The small Muscles of the Aspera Arteria.
- I I. The Artery of the Lungs divided into two Branches.
- K K. The Carotides, the left of which seems to proceed immediately from the Heart.
- L. The Cross or bending of the Aorta on the right side.
- M N. The Heart.
- N. The Right Auricle.
- O O. The Liver.
- P. The Gall-Bladder.
- Q. The Ductus which conveys the Choler into the Intestine.
- R. The Intestine.
- S. The Ventricle or Gizzard.
- T T. The Venæ Iliacæ.
- V. A single Testicle fastened to the Bifurcation of the Iliac Veins.
- X X. The Emulgent Veins.
- Y. The continuation of the Trunk of the Aorta beyond the Venæ Iliacæ.
- aa. The Iliac Arteries which do serve for Emulgents.
- bb. The Kidneys.
- cc. The Ureters.

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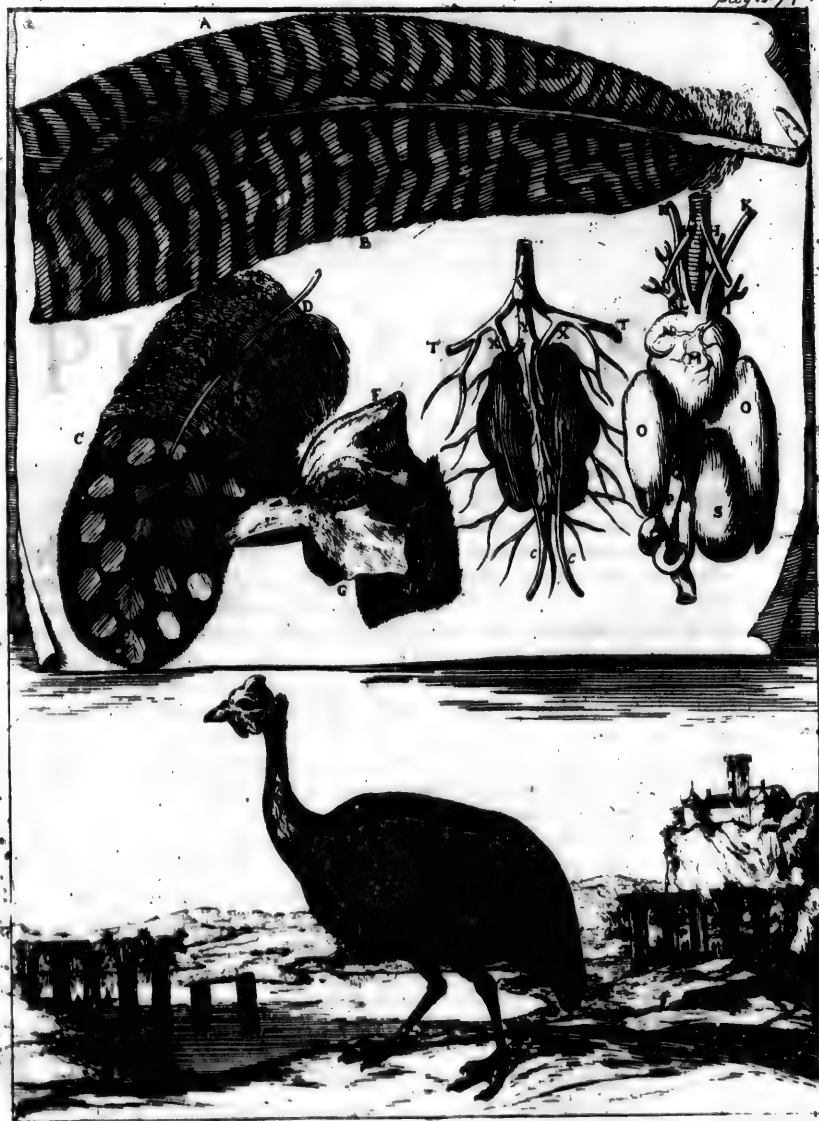
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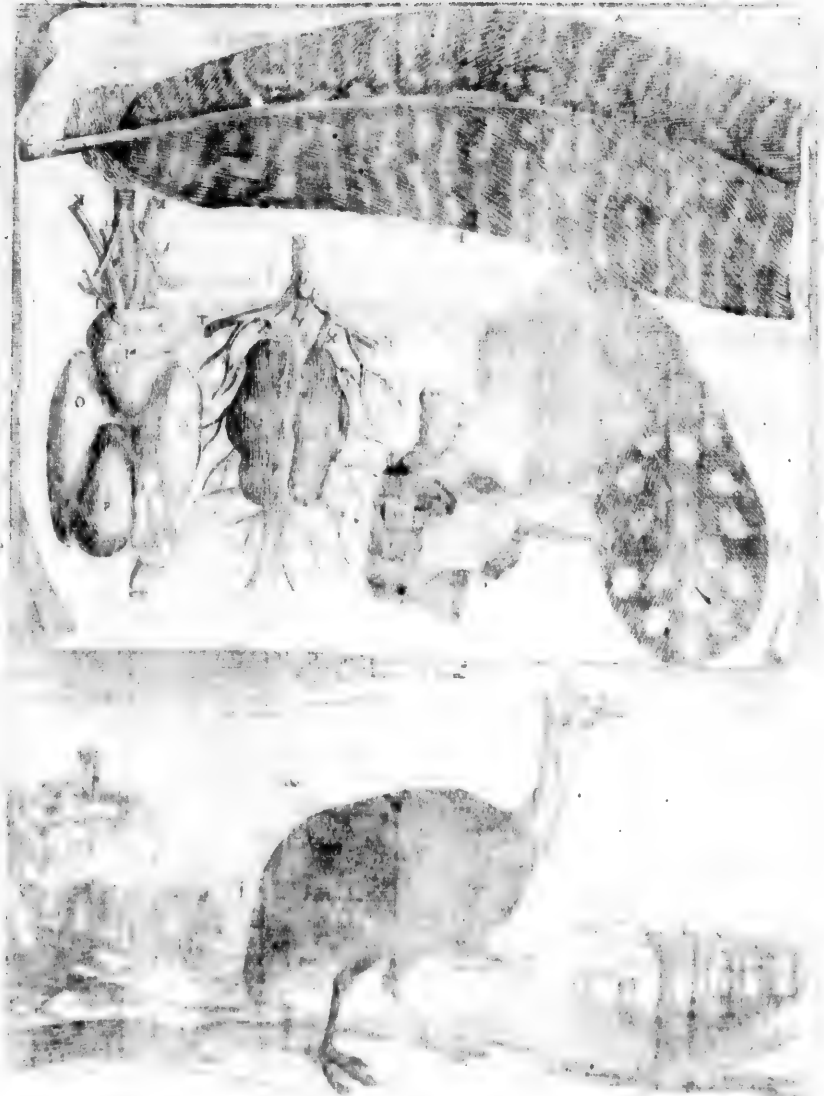
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T H E
ANATOMICAL DESCRIPTION
O F T E N
P I N T A D O S.

THe Birds which we describe are a kind of Hen called *Pintado*, by reason of the exactness of the Figures which seem as if Painted on its Plumage; these figures not being irregular and as it were accidentally made, as in the generality of other Birds. Upon this very reason some of the Ancients made Choice of the Names which they have given to these Fowl: For by *Varro* and *Pliny* they are called *Varia*, and by *Martial* *Guttata*, by reason of the white Spots wherewith their whole body is diversified and Speckled, as it were with several drops. Their Eggs are likewise Painted, and Chequered with white and black: thus this sort of diversitie is a thing Natural and perpetual to these Birds, which this particularity distinguishes from common Hens, which in the *Genus* of Birds are almost the sole ones, which have not the Plumage alwayes with the same Colours in their Species; Hens being indifferently white, black, gray, yellow, or mixt with all these colours. Other Authors have given to the *Pintado's* Appellations taken from the Country where they do generally breed (which is *Africa*) by calling them *Hens* of *Africa*, *Barbary*, *Numidia*, *Guinea*, *Mauritania*, *Tunis*, *Pharos*, that is to say *Egypt*. *Margravius* reports that in the Kingdome of *Congo* it is called *Que-sele*. *Pliny* relates that they are also called *Meleagrides*, because that according to the report of his time, they went annually from *Africa* into *Beotia*, and come to beat themselves near the Tombe of *Meleager*, whose Story feigns that the Sisters were changed into these Birds. There are some which do think that the *Meleagris* is the *Cot-q-d'Inde* or *Turkey-Cock*; which shall be examined in the Sequel.

The ten *Pintado's* whereof we have made the Dissection, were of the size, and almost the shape of an ordinary Hen. Some are of Opinion that they do better resemble the *Partridge*. But the length of their Neck, and Leggs, which

which did even surpass that of the Neck and Leggs of Hens, have made us to disapprove this Similitude: We only found that they had the Tail bent down-wards like the *Partridge*, and not held up like the Hen. But they have no Characteristick more particular of the Hen than the fleshy Appendices which do hang down on both sides of their Jaws, which are not mett-with in any other Bird, and which even in the *Pintado* have something different from those which are in Hens; as shall hereafter be explained.

Their whole Plumage was only of two colours, *viz.* White and Black. The White was every where perfectly White: the Black was also in some places perfectly Black, but in the most it was faint, and inclining to a dark-Gray.

The top of the Neck instead of Feathers, was only garnisht with a black Down, which did better resemble Hair than Feathers. These Hairs being about two lines long, were turned upwards, contrary to the ordinary situation of Hair and Feathers. In one of our Subjects, towards the hinder part of the Head, these Hairs were almost an inch long, and made as it were a Tuft. The under part of the Neck had little dark-gray Feathers marked with White. These Feathers went insensibly three inches in length and one in Breadth. The half of these Feathers, towards the root on both sides of the Quill or Stem, was garnished with Beards or branchings like grayish white Down, above half an inch long on each side. Each Down or Beard was dishevelled, and divided as it were into several fine Locks or threads towards its extremity. Near the Quill or Stem the roots of each beard were joyned together by the Crochets or little Fibres wherewith the Beards or branchings of the feathers which do serve for flight, use to be fastened, and which are described in the *Ostrich*. The other half of these Feathers was composed of these same sort of Beards or Branchings, which are harder and firmer. They were of a dark-gray intermixt with white round Spots, two lines Diameter at the most. They by an equall order did make three rows on each side with six in each row; so that the sixth of every row, which was common to the opposite rank, whereof it did likewise make the sixth, did meet on the tail of the Quill or Stem. This Quill which was black, did grow white at the place of the mark or Spot, as if on a black Skin there had been thrown some drops of *Aqua-Fortis*, which had discoloured it: Which illustrates the thought of *Martial*, by whom the *Pintado's* are called *Guttata*.

The Feathers of the Wing's were marked after another manner, having two Sorts of Spots, some of which were round, and others long. These marks were white, on a dark ground of three different Kinds: for at the place where the Feather is covered with another Feather, this ground was simply dark-gray; In the rest of the Feather this ground was absolutely black at the Circle of the white Spot; the rest was mixt with white and black Specks.

Clytus Milesius Aristotle's disciple, who describes the *Pintado* in *Athenaeus* with great exactness, principally enlarges upon the particularities of the shape and colour of the Spots of these Feathers, and even to the having observed that the black which edges the Spots is reciprocally intermixt with the white in form of a Saw; which is very difficult to comprehend, if one

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fees not these feathers, or their figure: wherefore we have in our Figure exactly designed them.

The Tail as has been sayd, was a little bent down-wards as in *Partridges*. The Leggs were covered with little feathers layd, and as it were glued, upon the Skin; they were of a dark-Gray and spotted with White like all the rest.

The Head had no Feathers; the upper Eye-lidd had only long black hairs, which were raised upwards. At the top of the Head there was a Crest, or kind of Casque, which Modern Authors do compare to the Bonnet of the Doge of Venice. This Crest is by *Margravinus* called *Mitella Cutacea*. We found that it was only covered over at top with a dry and wrinkled Skin of a dark Fawn Colour, which was extended from the Beak to the hinder part of the Head which it covered, being cutt away over the Eyes. But the inside was of a Spongie Substance, softer than the Bone, and resembling, as say's *Clytus*, a flesh hardened and dried like Wood: which may make one to think that *D' Alechampius* and *Casaubon* had no reason to correct the ancient exemplars of *Athenæus*, where it appears that this Crest is τὸ σῶμα ξυλοειδές, by putting τὸ χρώμα instead of τὸ σῶμα: for altho the colour of this Crest resembles some sort of Wood, yet indeed its substance has more resemblance with all sorts of Wood than its colour, because that the colours of Woods are much more different amongst themselves than their Substances. *D' Alechampius* is perhaps mistaken, when he say's that this Crest is peculiar to the Males; for we have found it in all our Subjects as well Males as Females.

The Eye was large and open; the Poet *Sophocles*, according to *Pliny*, averr's that the yellow Amber is made of the Tears which do drop from the Eyes of the *Pintados*, which are beyond the Indies.

The Beak was like to that of an Hen. In two of our Subjects we found, on the middle of the root of the Beak, a Tuft composed of twelve or fourteen threads four lines in length, and about the bigness of a small Pin, of colour and Substance like the Bristles of a Hog. On each side of the Beak a blewish Skin was extended towards the Eye, which it incircled, and grew black there. *Belonius* positively affirms that it is White round about the Eye. This Skin made the Eye-lids, and covered the two Appendices with a Substance half fleshy and half Cartilaginous: they hung down on both sides the Cheeks, being fastened to the upper Jaw, and not to the lower, as they are in Hens, and as *Belonius* has Painted them in his *Pintado*. We found them of different shapes in our Subjects: for in some they were Oval, in others square, in others Triangular. They were also of different colours. *Margravinus* simply declares that they are Red. We observed that they were Red in the Females, and Blew in the Males; although all Authers do report that this Bird has not any exterior Mark which makes the distinction of Sex. On this difference of Colours *Columella* grounds a distinction between the *African* or *Numidian* Hen and the *Meleagris*, saying that the *African Hen* has its Appendices Red, and that the *Meleagris* has them blue: But there is no probability that such a difference can constitute divers Species, seeing that these Colours may easily change in the very same Individual upon light occasions, as is observable in the *Turkey-Cock*, in whom the Combe Waxes Red when he is Angry, and who has it generally blue.

At the side of these *Appendices* backward, there is plainly seen the hole of the Ear, which in other Birds is hid by the feathers which do adorn the Head; this hole was extraordinary little, perhaps by reason it is uncovered.

The *Feet*, which, as has been say'd, were very high, were of a dark gray. Some great Scales covered them before; and behind they had only a Skin made rugged by an infinite number of small Eminencies like those of *Chagrins*. The three fore-Toes had, even to the third of their length, a Skin which joyned them together as in the *Goose*. The hind-Toe was short, and the Males had no Spurr behind the Foot.

After having made these remarks on the *Pintado*, and read what the Ancients have written of the Bird *Meleagris*, we think it very hard to be of the same Opinion with *Turnerus*, *Belonius*, *Gesner*, *Aldrovandus*, and all the Authors which have writt of these Birds, and which do hold that the *Meleagris* of the Ancients is the *Turkey-Cock*, and not the *African Hen*, or *Pintado*; for it is easie to prove that whatever the Ancients have reported of the Bird *Meleagris* is found in the *Pintado*, and that nothing of all this occurs in the *Turkey-Cock*, which on the contrary has some things particular which are not in the *Meleagris* of the Ancients. For the particularities which *Clytus* attributes to the Bird *Meleagris*, viz. the Crest of a Lignous Colour and Substance, the Beards or *Appendices* of the Cheeks, the numerous white Specks almost regularly and with Symmetry placed on the feathers, of the shape and size of a Lentill, the Leggs without Spurs in the Male, and the perfect resemblance of the Male and Female, are seen in the *Pintado* and are not found in the *Turkey-Cock*. What *Pliny* reports of the Bird *Meleagris* do's very well agree with the *Pintado*, but not at all with the *Turkey-Cock*: for he say's that the *Meleagris* is a Bird that lives in Lakes and Rivers: now the Skin which the *Pintado* has between the Toes of the Feet in found only in Animals which do love and delight in Watry places, where it is known that the *Turkey-Cock* takes no pleasure. In fine, in the exact Description which the Ancients have made of the *Meleagris* it is impossible, if it were the *Turkey-Cock*, that they should omitt the remarkable and particular things which appear in the *Turkey-Cock*, and which are not found in the *Pintado*, such as are the way of displaying its Tail, of dragging its Wings against the ground, of extending and suffering the Comb on its head to hang, of having the Neck rough and wholly void of feathers, and of having a Lock of black Hair at the Breast.

As for what respects the Inward parts, we found the *Oesophagus*, as in most Birds, ranged on the right side of the *Aspera Arteria*. It was enlarged before its entrance into the *Thorax*, and made a *Craw* of the bigness of a Tennis Ball, when it was blown up; afterwards it was contracted to pass thro the *Thorax*. This contracted part measured two inches and a half in length. This whole *Oesophagus* was spread over with a great quantity of Vessels, which were not visible in the passage, which from the dilatation that we have taken for a *Craw* passed to the *Gizzard*; this passage being of a Substance harder, whiter, and more Nervous than the rest. The *Gizzard* was as in the Hen. It was found for the most part filled only with Gravel. Its internal Membrane was very much plaited, and easily separable from the fleshy part. Its substance was like to white glue; so that this Membrane being separated from the *Gizzard*, was easily dried, and waxed hard and brittle like Glass.

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The *Intestines* were three foot long without reckoning the two *Cacums*, which were each six Inches. The *Duodenum* was much larger than the others, being above eight Lines. The *Cacum's* were not of a uniform breadth as in the generality of Birds, but did go enlarging. They were fastned by the Membranes of the *Mesentery*, and received vessels therefrom like the other *Intestines*. There was no *Pancreas*.

The *Liver* was divided into two Lobes, which at the top had each a Cavity to receive the point of the Heart. The Cavity of the right Lobe was greater and deeper than that of the left, because that the point of the Heart was turned towards the right side. The lower extremitie of the Lobes was fastened to the *Diaphragme*, which descends from the top downwards, and to the Bladders which the Lungs form in the lower Belly of Birds. In most of our Subjects the Liver was Scirrhus, and filled with a great quantity of hard yellow Grains, some as large as Pease, and others less. We found a *Gall-bladder* only in two of our Subjects. In the one it was nine Lines in length and six in breadth. It had a *Ductus* from its bottom, which was inserted into the *Intestine* near the *Pylorus*. In the other, it was an Inch and half long, and four Lines broad, being fastened to the hollow part of the right Lobe; and the *Ductus* was from its middle, and not from its lower extremitie, and inserted it self into the *Intestine*, four Fingers beneath the *Pylorus*. In the other Subjects which had no *Gall-bladder*, the *ramus Hepaticus* was there found very large and visibie. It measured five Inches in length, and was inserted into the *Intestine* six Inches beyond the *Pylorus*.

Towards the upper part of the *Gizzard* there was a body, of an oval Figure nine Lines long, and of a dark red Colour, and a firm Substance. It had connexion with the Trunk of the *Vena Porta*, with that of the *Cava* and *Aorta*, and with the *Intestines* and *Ventricle*, by some very visibie branches. Some Modern Authors have observed that Birds which have a fleshy *Ventricle* have no Spleen. Yet we are of Opinion that this body could be no other thing than a Spleen, as well by reason of these Connexions, as of the Sympathie which it seem'd to have with the Liver: because it was found that in all the Subjects where the Liver was Scirrhus, this part was after the same manner; altho' the hard and compact Substance of this body in the subjects where it was Scirrhus, and its Figure so regularly oval, might cause a belief that it was a *Testicle*: but there were two other round bodies, four Lines Diameter, couched on the Loyns, and fastened to the Trunks of the *Vena Cava* and *Aorta*, which were the true *Testicles*. In one of the Subjects these round bodies were single, and fastened on the place of the division of the *Iliaks*.

The Air being blown into the *Aspera Arteria* it made all the Bladders to swell, which received the Air after it had passed thro' the Lungs, and of which there are some that do descend into the lower Belly of Birds; it is observed that the *Pericardium* was likewise blown up. This Remark may be of some Importance to discover the uses of Respiration, and the Advantages which the Air, being by this means introduced into the *Thorax*, may bring to the Heart, by the Compression it may there cause, by the Impression of its

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and on the whole, the results of the investigation are as follows: The first of the points investigated was the question of the existence of a "critical" temperature for the liquefaction of gases. It was found that such a temperature does exist, and that it is the same for all gases. The second point investigated was the question of the existence of a "critical" pressure for the liquefaction of gases. It was found that such a pressure does exist, and that it is the same for all gases. The third point investigated was the question of the existence of a "critical" volume for the liquefaction of gases. It was found that such a volume does exist, and that it is the same for all gases.

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1. The first of the points investigated was the question of the existence of a "critical" temperature for the liquefaction of gases. It was found that such a temperature does exist, and that it is the same for all gases. 2. The second point investigated was the question of the existence of a "critical" pressure for the liquefaction of gases. It was found that such a pressure does exist, and that it is the same for all gases. 3. The third point investigated was the question of the existence of a "critical" volume for the liquefaction of gases. It was found that such a volume does exist, and that it is the same for all gases. 4. The fourth point investigated was the question of the existence of a "critical" density for the liquefaction of gases. It was found that such a density does exist, and that it is the same for all gases. 5. The fifth point investigated was the question of the existence of a "critical" surface tension for the liquefaction of gases. It was found that such a surface tension does exist, and that it is the same for all gases. 6. The sixth point investigated was the question of the existence of a "critical" viscosity for the liquefaction of gases. It was found that such a viscosity does exist, and that it is the same for all gases. 7. The seventh point investigated was the question of the existence of a "critical" thermal conductivity for the liquefaction of gases. It was found that such a thermal conductivity does exist, and that it is the same for all gases. 8. The eighth point investigated was the question of the existence of a "critical" electrical conductivity for the liquefaction of gases. It was found that such an electrical conductivity does exist, and that it is the same for all gases. 9. The ninth point investigated was the question of the existence of a "critical" magnetic permeability for the liquefaction of gases. It was found that such a magnetic permeability does exist, and that it is the same for all gases. 10. The tenth point investigated was the question of the existence of a "critical" refractive index for the liquefaction of gases. It was found that such a refractive index does exist, and that it is the same for all gases.

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The Explication of the Figure of the Eagle.

THe lower Figure represents only one of the *Eagles* which are here described, because that they were almost all alike. The main and principal difference was in the Feathers of the Neck, which were composed only of a very long and smooth down in the Male; whereas in the Females they were like Scales. It must be likewise observed, that the greatness of the Claw of the hinder Foot could not be represented such as it would appear, if these Claws were not hid, as they necessarily are by the Bough on which the *Eagle* is perched.

In the Upper Figure.

- A. *The Trunk of the Vena Porta.*
- B. *The Neck of the Gall-Bladder.*
- C. *The Ductus Cysticus.*
- D. *The Ductus Hepaticus.*
- E. *The Spleen.*
- F. *The Pancreas.*
- G G G. *The Branches of the Vena Porta and Cæliaca Arteria, which go to the Spleen and Intestines.*
- 1 2 3. *The three Ductus Pancreatici.*
- H. *The Aspera Arteria.*
- I. *The Oesophagus blown up.*
- K. *A glandulous body fastened to the upper part of the Oesophagus.*
- L. *The Ventricle.*
- M. *The Spleen.*
- N. *The Branches which are distributed to the Spleen and Intestines.*
- O. *The Pancreas.*
- P. *The Tongue as bigg as the Life.*
- Q. *The Eyes.*
- R. *One of the Feathers of the Breast which is composed only of Threads like Down, and which has two Stems like two Branches which proceed from a third, which is as it were the Trunk.*
- S. *The Medulla Spinalis divided and separated as it were into two Branches which afterwards joyned again.*
- T T V X. *The same Marrow cut through, to shew how the two parts T T, which divide in two the Trunk of the Marrow on the fore-side, are joyned together at the hinder part X, to form the Cavities V.*
- Y Y. *Two small Appendices which supply the place of the Cæcum, having on the inside a very small Cavity.*

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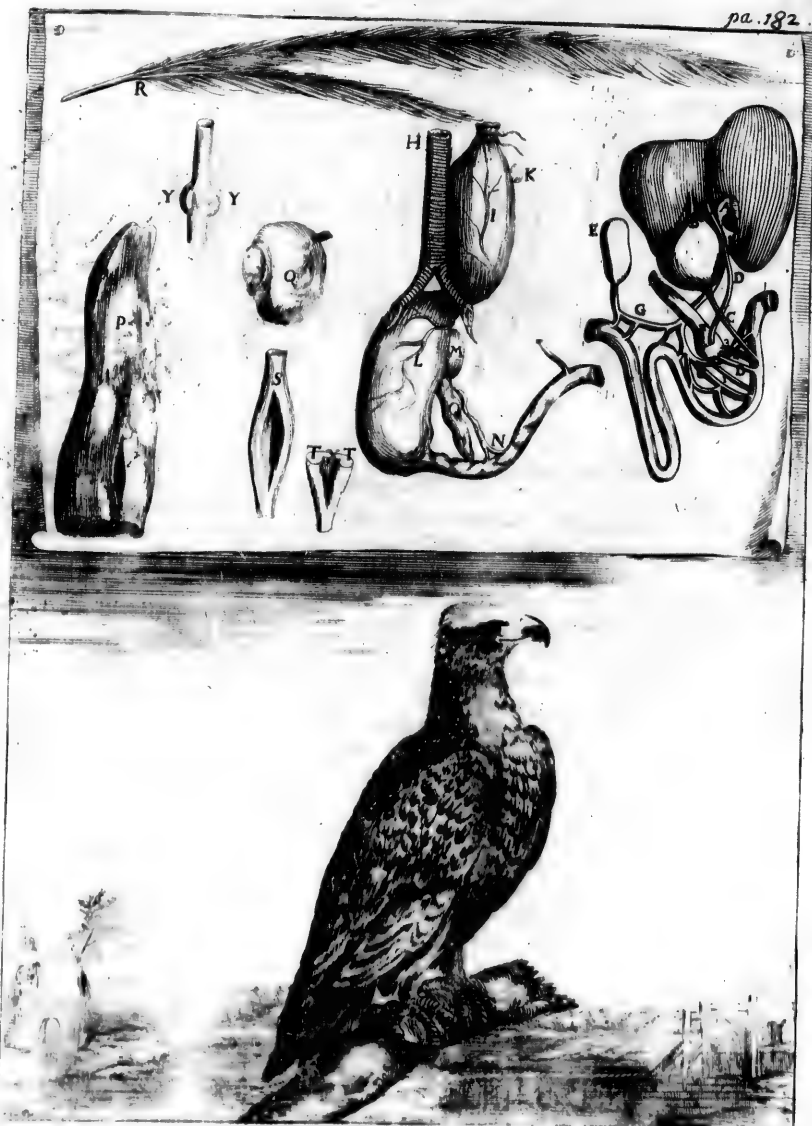
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ANATOMICAL DESCRIPTION
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These three *Eagles* were almost alike in bigness forme, and Plumage. The inward Parts were in some things different, principally because they were of different Sexes. The greatest which was a Female, measured from the Extremity of the Beak to that of the Tail, two Foot nine Inches ; from the end of one Wing, to the end of the other, when expanded, seven Foot and a half. The Beak was two Inches and a half long, without comprehending the bending, which was nine Lines. The whole Head, comprehending the Beak, was four Inches and a half ; the Neck five Inches and a half ; the Leg together with the Thigh, to the extremitie of the Talons, fifteen inches. It weighed ten pounds. Its whole Plumage was of a Chest-nut Colour almost black, except the bottom of the Neck before, and of the Belly, which was of a white sullied with a reddish gray. The Feet were small in proportion to the Body, and of a blewish gray. The Beak was all Black.

The two others, one of which was a Male and the other a Female, (and which were somewhat lesser) had the Beak black at the end, yellow towards the beginning, and blewish at the middle. The Feet were yellow, covered with Scales of different sizes ; those at top of the Toes being large and square, especially towards the extremitie ; the other being very small. The Talons were black, crooked and very great, especially that of the hinder Toe, which was almost as big again as the others.

The Plumage was of three Colours, viz. dark Chest-nut, red, and white. The top of the Head was mixt with Chest-nut and red. The Breast and Belly were mixt with white, red, and Chest-nut : the Wings had a great deal of Chest-nut, little red and less white. The Quills of the great feathers of the Wings were nine lines in compass. The Plumes of the Tail were very brown towards the extremitie, having something of white towards their Origine. The Thighs and Leggs even to the beginning of the Toes, were covered

covered with Feathers half white, and half red, each Feather being red at the end, and white towards the beginning.

Naturalists do say that *Eagles* have the Leggs thus provided with Feathers as well to defend them from the Beak and Claws of Birds, when they catch and take them in their Talons, as to keep them from the cold of the Snow, to which they are exposed on the tops of the Mountains where they generally reside. *Belonius*, who has described several sorts of *Eagles*, has described them all without Feathers on their Leggs.

Besides the great Feathers which covered the Body, there was at their root a very white and fine Downe, about an inch long. This Downe serves likewise to Arm the *Eagles* against the Cold, of which they are very sensible: which is the reason that Falconers, when they make use of *Eagles* for high flying, do take from them a part of that Downe and of the other Feathers from their Belly, to the end that they rise not too high, being hindered by the cold of the middle Region of the Air. The other Feathers which covered the Back and Belly of our *Eagles*, were four or five inches long. Those which covered the Thighs on the outside, were six inches, and reached three inches beyond the Heel. Those whereby the Breast and Belly were decked in the Male measured seven inches in length and three in breadth: they were soft, having on both sides only a long Downe, the fibres of which were not clasped together, as they generally are in the strong Feathers which are ranged like Scales. These Feathers were double: for each Quill being come out of the skin about two lines and a half, did shoot two unequal Stems, the one being as large again as the other. We have observed the same thing in the Feathers of the Neck and Belly of a *Parrot*, and in all the Feathers of a *Cassowary*. *Belonius* reports that the Bird which he calls *Cock of the Wood*, and which he thought to be the *Terrix* of *Aristotle*, has of those sorts of Feathers, and that he has not seen any other Bird have the like.

The Eye which was sunk in the *orbite*, and covered with an Eminence of the *os Frontis*, which made as it were an advanced Eye-brow, was of a very brisk *Isabella* colour, with the lustre of a *Topaze*. The *Cornea* was raised with a great Convexity upon the *Sclerotica*, which made an edge elevated round the *Cornea*. This Border was hard and Bony. The *Conjunctiva* was of a very lively red. The *Eye-lids* were large each being capable of covering the whole Eye. Besides the upper and lower *Eye-lids*, there was an Internal one, which was drawn into the great *Canthus* or corner of the Eye, and which being extended towards the little one, did intirely cover the *Cornea*.

Aristotle and *Pliny* do make six kinds of *Eagles*, which are the *Pygargus*, *Morphnus*, *Perenopteros*, *Melanaetos*, *Haliaetos*, and *Chrysaetos*; but they do not wholly agree in the Description which they do make of them, chiefly in what concerns their size: in the rest of the description they could not be so different by reason of the names which the *Greeks* have given them, by which these Species are described, by attributing to them some Marks which distinguish them. These marks have made us also to find out the Species to which we judge that our *Eagles* must be referred, as well by reason of the Particularities which do make them agree with these Species, as by reason that those of the other Species are wanting in them. Thus we do think that

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two of our *Eagles* which were the least, might be ranged under the last Species, which is the true *Eagle*, commonly called in *French*, *Royale*, by *Aristotle*, *Gnepsos*, and by *Alian* *Chrysaetos* and *Asterias*; by reason that the red, and as it were gilded Colour of the Plumes, is expressed by the Greek Name *Chrysaetos*; and that the spots which they have on the Belly and Thighs, do represent the Stars signified by the Name *Asterias*, which all Interpreters do report to have been given to this *Eagle*, only because of these red spots. Moreover these *Eagles* could be neither the *Pygargus*, that is to say the white-tail'd *Eagle*; nor the *Morphnos*, that is to say the *Eagle* whose Plumage is of a dark Colour; nor the *Melanactos*, that is to say the sole black *Eagle*; nor the *Pernopteros*, that is to say the *Eagle* whose Wings are spotted with black; nor the *Haliaetos*, that is to say the *Eagle* which resides near the Sea, that is reported to have blewish Feet: Because that these two *Eagles*, as appears by the Description, had not the Tail white, nor the whole Plumage of a dark Colour, were not all black, nor had the Wings speckled with black, nor the Feet blue; so that our great *Eagle*, which had the blueish Feet, might be the *Eagle* which abides near the Sea called *Haliaetos*, for this reason, besides that it had the Wings very dark, as *Ovid* describes it in the *Metamorphosis* of King *Nisus*, who was changed into this Bird; that it had the Breast and Belly white, according to the Description of the *Haliaetos*, made by an Anonymous Author whom *Aldrovandus* cites; that its Feet were almost all covered with square Scales, having a great many less square than in the other *Eagles*; which *Belonius* affirms to be peculiar to this kind of *Eagle*, to which *Aristotle* attributes that which is spoken of all the *Eagles*, viz. that they do reject those of their young which cannot steadfastly behold the Sun.

Some difficulty might arise about the size which was indifferent in our two Royal *Eagles*, each not exceeding six pounds in weight; whereas the *Eagle Chrysaetos*, which *Aldrovandus* describes weighed ten. But it must be considered that our *Eagles* were young, as appears by the white Feathers which they had upon the Neck, Wings, and Tail, which do change Colour in the *Eagles* when they do wax old, and do grow of a gilded or dark chestnut Colour, as *Gesner* has observed: Add moreover that it has been said that *Aristotle* and *Pliny* agree not upon the size of the *Eagles* of different Species; *Aristotle* making that which he calls *Gnepsos*, which is that which *Alian* and *Pliny* do call *Chrysaetos*, the greatest of all; and *Pliny* saying that it is only of a middle size, and that that which is called *Pernopteros*, is the biggest.

Pliny say's that Birds have no *Epiploon*: yet our two Royal *Eagles* had Membranes, which like a sack did inclose the *Intestines*, Liver and *Ventricle*; which *Corseus* has likewise observed in making the Dissection of an *Eagle*: We found such an *Epiploon* in other Birds. This Membrane proceeded from those which do form the Bladders which are in the lower Belly in Birds, and which do swell by Respiration. It had a great deal of Fat, especially over the *Ventricle*, which might cause a belief, that this Fat had the same use in this Bird as in *Terrestrial* Animals, where it is thought that it serves in the *Epiploon* to foment by its heat that of the *Ventricle*; at least it is ob-

served that *Carnivorous* Animals have the *Epiploon* furnished with a great deal of Fat.

The *Oesophagus* which was on the right side of the *Aspera Arteria* was extended even to two Inches and a half in Diameter, and six Inches in length when blown up, on the inside. Towards the top there was a *glandula* Body hard and firmly fixed to the Membrane; it was about the bigness of a Pea; it was found only in one of the Subjects. Underneath the place where the *Aspera Arteria* was divided in two, the *Oesophagus* was contracted, and did pass underneath, then was enlarged to form the *Ventricle* which resembled it in Size, Figure and Substance: For both the one and the other was composed of Membranes hard, white, and mixt with several Vessels on the outside. The inside was different; the bottom of the *Oesophagus*, which formed a *Crop* or *Gran*, was composed of small *Glands*, which towards the bottom were about the bigness of a Rape-seed, and went continually lessening, untill they insensibly became imperceptible. The *Ventricle* had some wrinkles, which multiplying towards the bottom, did render it thicker than towards the topp. These two *Cavities*, as well that of the Breast, as that of the *Ventricle*, were very large, and proportioned to the *Voracity* of this Bird, which *Naturallists* report to be so extraordinary, that it ravages all the adjacent places, which do hardly suffice to furnish it with the Prey necessary for its Nourishment. Thus it is observed that there are not found two *Eagles* in the same Quarter. *Alian* reports that the *Eagles* not being satisfied with the great Birds that they do take, as *Cranes* and *Geese*, they do hunt *Rabbits*, *Hares* and *Kjids*, which they take up, and carry away; and that they have even the Craft and Subtily of killing *Bulls*, by making them to fall down *Precipices*, and then eat them, after that they are beaten in pieces by their fall.

The *Intestines* were small, after the manner of *Voracious* and *Carnivorous* Animals, contrary to those which do live only on Grass, and especially those which do chew the Cud, where they are generally four or five times longer and broader than in others. In our two *Royal Eagles* they were slender and short, and had no *Cacum* in the Male. The Female had two, each being two Inches in length. In the *Eagle Haliaetos*, instead of the *Cacum*, there were two small Bunches hardly visible on the outside, but which had on the inside two Pouches formed by *Tunnicks* like *Valves*. The *Rectum* was suddenly contracted near the *Anus*, and afterwards made a Pouch of the bigness and shape of an Egg, at the Extremitie of which the *Ureter's* were inserted: Underneath this Pouch there was seen the little Purse of *Fabricius*, the Figure of which is represented in the Plate of the *Bustard*.

The *Spleen* in the two *Royal Eagles* was round on the outside, flat on the inside and towards the *Ventricle*, to which it was immediately adherent: It was on the right side that it was fastened. It was eight Lines Diameter. Its Colour was a Red much darker than that of the Liver, which was of a very lively Red. Its Vessels which it received from the *Porta* and *Arteria Celiacæ* were large and wide. In the *Eagle Haliaetos* it was seated under the right Lobe of the Liver, and knit to the third fold of the *Intestine* by the Branches of the *Vena Porta* and *Arteria Celiacæ*, as in the other two.

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In this same *Eagle* the *Pancreas* was situated as in most Birds in the first fold of the *Intestine*, but it had a Figure altogether extraordinary. It was round at the lower end, making as it were a Head; the rest was flatter and thinner. This Head was perforated to give passage to the *Ductus Hepaticus*, which without having any Communication with the *Ductus Pancreatici*, went to insert it self into the *Intestine*. The *Ductus Pancreatici* were in number three: there were two which were inserted into the *Intestine* between the *Ductus Cysticus* and *Hepaticus*; the third was joyned to the top of the *Hepaticus*. The Insertion of these *Ductus's* had two things particular; the first was that their insertion was made into the *Duodenum*, whereas in Birds it is commonly into the Extremitie of the first doubling of the *Intestines*, which belongs to the *Jejunum*. The second particular is that the Mouth of all these *Ductus's* was each covered in by a little *Test*, which generally there is but one *Test* for all *Ductus's*, as well *Pancreatici* as *Cystick* and *Hepatick*. The *Pancreas* in the two Royal *Eagles*, was likewise seated very near the *Pylorus*, but it was fastned to the *Intestine* by a *Ductus* so small and short, that it was hard to be seen: at the other end it clinged to the *Spleen*, which was fastened and joyn'd to the upper part, and to the right side of the *Ventricle*, as has been already declared.

The *Liver* was a great deal bigger in these two *Eagles* than in the other: In both the one and the other the left Lobe was the largest. The *Gall Bladder* was likewise very large in all the three, having the bigness and form of a great *Chest-nut*. It was joyned to the right Lobe of the *Liver* only by its Neck, which was a passage of a Line and half big. The *Ductus Cysticus* proceeded from the bottom, over against the Neck. This Neck was joyned to the *Liver* after two different manners: for in the two Royal *Eagles* it hung to the end of the right Lobe which was the shortest, as has been said: This was the reason that the Bladder was quite out of the *Liver*. In the other *Eagle*, the Neck was fastened to the middle of the hollow part of the right Lobe as usually.

In the two Royal *Eagles*, the *Kidneys* were small, being only eight Lines Diameter: They were round and flatt, of a tawny Colour somewhat reddish. The *Eagle Haliaetos* had them almost like other Birds, which commonly have them very great in Proportion to other Animals, and of a particular Figure.

The *Testicles* in the Male Royal *Eagle*, were two small glandulous Bodies, shut up in *Membranes*. They were each of the bigness of a Pea, somewhat flattened, of a flesh Colour inclining to yellow.

The Females had the *Ovarium* and its *Ductus* as usually in Birds, and such almost as is described in the Figure of the *Damoiselle* of *Numidia*.

The *Tongue* was *Cartilaginous* at the end, and fleshy at the middle, having at its root two hard points like those which are at the bottom of the Beard of an Arrow. It was five Lines broad, an Inch and two thirds long, from the Mouth of the *Larynx* to the end, which was not pointed as in most Birds which have the Beak strait, but which was square as in the *Parrot*.

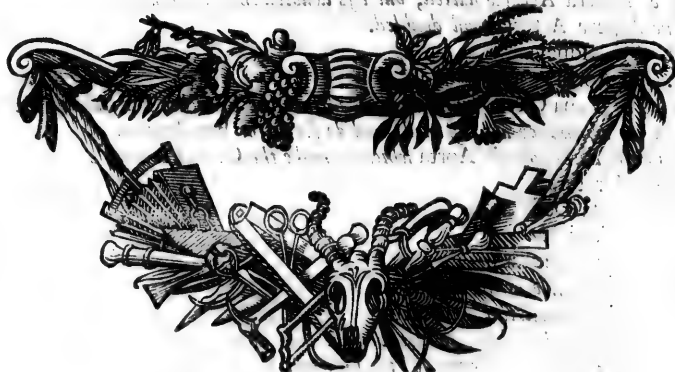
The small *Muscles*, which fasten the *Aspera Arteria*, did not take their Origine from the second *Clavicula* as in the generallity of Birds, but from the internal part of the top of the *Sternum*.

The *Globe* of the *Eye* in the *Female* was in its greatest breadth an Inch and half Diameter. That of the *Male* was three Lines less. The *Cornea* had a *Convexitie* which made it to rise above the rest of the *Globe* of the *Eye*, which was flattened before, as it is usual in *Birds* and *Fishes*, which have not the *Globe* of the *Eye* so Spherical as *Terrestrial Animals*. The *Cornea* in one of the *Eyes* of the *Male* was not transparent but had an opaque whiteness. Between the *Cornea* and *Chrysalinus* in this Subject the whole *Aqueous Humour* was found hardened and as it were petrified, about the thickness of two Lines. This *Cataract* was placed in the *Iris*, which was of a minime Colour, and which seem'd to have been altered therefrom. The *Crystalline* was four Lines and a half broad, and three and a half thick, being more convex on the inside than the outside. In the *Female* one of the *Eyes* was likewise spoiled, all the *Humours* and *Membranes* of the inside being corrupted, so that the whole was dissolved into a reddish water, without any appearance either of the *Crystalline*, *Aqueous*, or *Vitreous Humour*. The hole of the *Uvea* was closed by a thin, hard, and transparent Membrane. *Cortefius* who has observed this Membrane in the *Eye* of an *Eagle*, reports that it is found only in the Species called *Ossifraga*, which *Aristotle* for that reason calls *Epargemos*, that is to say which has as it were a Cloud over the *Eyes*. Our *Eagle* was never the less very different from the *Ossifraga*, which is not a true *Eagle*, but a kind of *Vultur*, whose plumage, according to *Aristotle*, is of a whitish Gray, which has not any resemblance with our *Eagle*.

The *Optick Nerve* was in this *Eye* extraordinary soft and tender. The Membrane which is peculiar to *Birds*, and which proceeds from the *Optick Nerve*, making as it were a Purse which goes to fasten it self at the other end to the *Ligamentum Ciliare*, was very black, and even more than the *Choroides*. Altho' we called it a Membrane, because that it appear'd a Membrane plaited, yet it was only a company of great black *Fibres*, which had some reddish ones in the middle, and which appeared to be *Vessels*. The *Optick Nerve* from whence this Membrane did proceed, was flattened, making as it were a cleft three Lines long. The *Base* of this Membrane which was of a triangular Figure, had the same breadth, and five Lines from its *Base* to its point. The *Retina* was very thick and Opaque, especially all the bottom of the *Eye*, where it was plaited and wrinkled. In this place there was no *Tapetum* over the *Choroides*.

In one of our Subjects a Remark was made upon the structure of the *Medulla Spinalis*, which was at first thought to be peculiar to this Subject, but which was afterwards discovered to be common to other *Birds*. It was found that towards the middle of the Back the exterior part of the Marrow was divided and separated in two, and afterwards rejoyned; the interior part remaining intire, and being only dilated: which makes the Figure of a leaf. This separation of the exterior part, and this dilatation of the Interior, was an Inch and half long, and eight Lines broad in this Subject, and in other *Birds* proportionably. We always found in the Cavity which the two separated parts do leave in the middle, a white and glutinous Humour, which appear'd to be the *Lymphatick Humour* condens'd.

If the Principal use of the *Ventricles* of the *Brain* is to receive their Excrements, it may probably be said, that this Cavity which is peculiar to Birds, is as it were a *Ventricle* of the *Medulla Spinalis*, which being included within Bones, that have not a free Motion, such as is that of the flexible *Spine* of other Animals, it wants the means which this Agitation might give it, to disengage it self of these Excrements, and dissipate them; so that it requires some Receptacle to receive them. This Conjecture will give us occasion to search whether there are any particular *Ductus's* for the discharge of these Superfluities.



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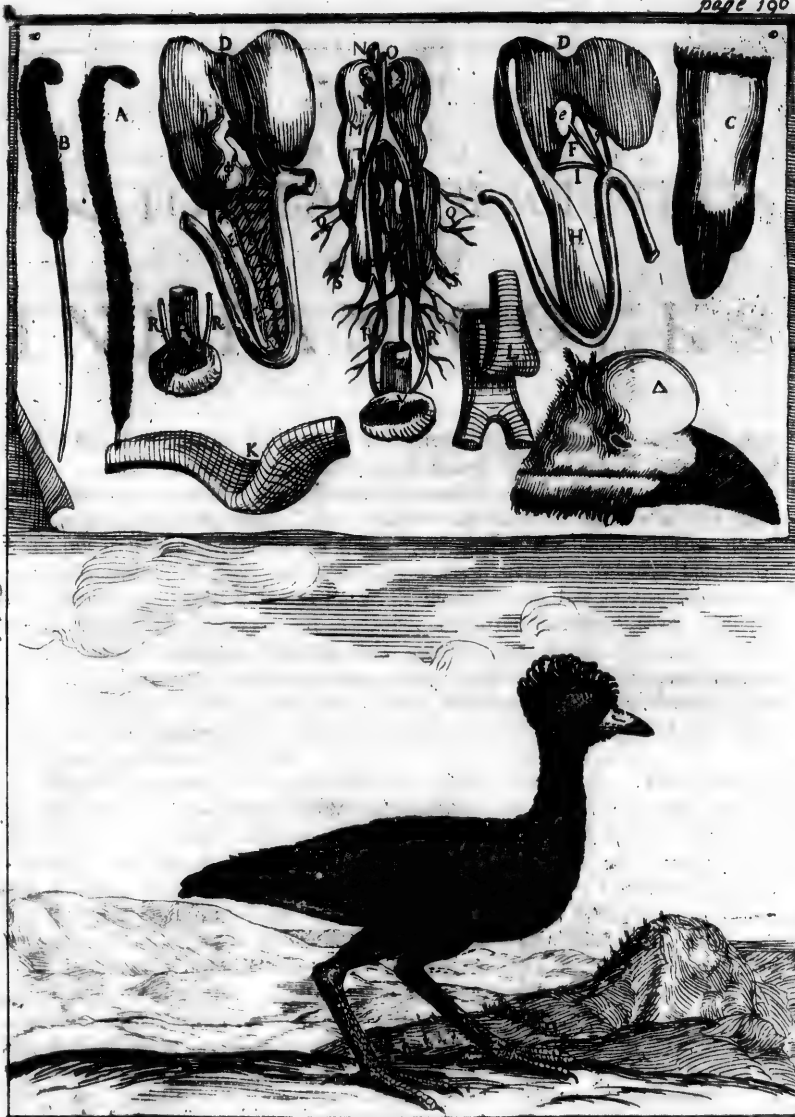
The Explication of the Figure of the Indian Cock.

OF the two *Indian Cocks*, that is represented in the lower Figure whose Beak had no Bunch, but which had three points at the end; and which had no white Feathers at top of the Tail; because that the other is found figured and described in *Aldrovandus*.

In the Upper Figure.

- A. *Is one of the Feathers of the Crest in its Natural bigness.*
- B. *Another of the Feathers of the Crest, whose Fibres are half shut up in a Membranous Ductus.*
- C. *The Beak, which has no Bunch at top, of its Natural size, and divided into three at the end.*
- Δ. *The Beak which has a Bunch.*
- D. *The Liver.*
- e. *The Oval Gall-Bladder.*
- F. *The Ramus Cysticus.*
- g. *The two Remi Hepatici.*
- H. *The single Pancreas.*
- I. *The Ductus Pancreaticus.*
- K. *The Aspera Arteria flattened, but less doubled than the other.*
- L. *The Aspera Arteria most doubled.*
- M M. *The Kidneys.*
- N N. *The Aorta,*
- OPP. *The Vena Cava, which is divided into the Branches PP, laid on the Kidneys, to which they are fastened, and do serve for Emulgents.*
- QQ. *The Branches of the Aorta which do make the Crural Artery's*
- RR. *The Ureters.*
- S T. *The Vasa Deferentia.*
- XX. *The Testicles.*
- YY. *The Epididymides,*
- ZZ. *The extremitie of the Rectum.*
- V. *The Penis fastened to the Rectum.*
- Γ. *The same Penis lifted up, to discover the hole of the Rectum which is between Γ and Π, and the Aperture of the sack which is under the Rectum, which opening is underneath Π.*
- φ. *The Anfractuus Gall-Bladder. having the Figure of a Cæcum.*
- α β. *The Two Ductus Hepatici.*
- γ. *The Ductus Cysticus.*
- δ δ. *The Two Ductus Pancreatici.*
- ε ε. *The right Pancreas which is under the Mesentery.*
- ξ ξ. *The left Pancreas which is layd upon the Mesentery.*

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THE
ANATOMICAL DESCRIPTION
OF TWO
INDIAN COCKS

THIS Bird we call *Indian Cock* to distinguish it from that which is very common amongst us, called *Cock d' Inde* or *Turkey-Cock*. It was brought from *Africa*, where we are told that it is called *Ano*. But because that Name is not known; that all the Authors which have spoken of this Bird have put it under the Genus of *Cocks*; and that *Gallus Indicus* is the name which *Longolius*, *Gesner*, and *Aldrovandus* have given it, *Johnston* being the only person that calls it *Gallus Persicus*; we have called it *Indian*, according to the opinion of the fore-cited Authors, and after the example of those by whom the Bird which is thought to be the *Meleagris* of the Ancients, is called *Turkey-Cock*, altho' it comes from *Africa*: add moreover that according to our conjectures the Bird which we speak of, is found in the *West-Indies*, where according to *Margravins* it is called *Mitu-paranga*, which *Benzo* in *Clusius* Reports to be a kind of *Peacock*.

We dissected two which were Males. *Aldrovandus* describes the Female, and makes it in some thing different from the Male, which he saw only in Painting; and declares not in what state he saw that Female. *Longolius* saw only the Skin of the *Indian Cock* which he mentions. The two which we describe, differed from each other only in the Beak. They were about the size of a middling *Turkey-hen*. Their Plumage was perfectly black on the Head and Neck: all the rest had a greenish Eye mixt with black, except the Back, whose Plumes towards the Root were of grayish Colour like the wood of a *Wall-nut*. The lower *Venter*, the top of the Thighs behind, and the under part of the Tail had white Feathers. *Margravins* says that the *Indian Cock* of *Brazile* is green, perhaps because it is less brown than ours, and that the green inclines to a brown: but the deepness or faintness of Colour ought not to change a *Species*, when it is established by more important Circumstances, such as are the things in which the *Indian Cock* of *Margravins* and ours do agree.

On the Head from the Beak to the beginning of the hinder part of the Neck, there was a Crest or Plume of black Feathers, two Inches and a half long.

long, two Lines and a half broad, erected, and a little leaning backwards, with their extremitie bent forward. The Neck towards the top was garnished with small Feathers about the breadth of those of the Crest, but a great deal shorter, not exceeding four Lines in length near the Head: They increased in bigness as they approached the bottom of the Neck towards the Breast, even till they were two Inches long, and one broad.

The Feathers of the Tail were mixed, some being black, others white. In one of the Subjects there were white ones only underneath the Tail; in the other there were also white ones mixt with black at the top of the Tail. There were several of these Plumes whose Beards were shut up in a long quill or stem made of a very thin white Membrane, which sometimes incompart them even to the end, leaving only a small Tuft to be seen. This Quill, where it lockt up the *Fibres* of the black Feathers, appeared blue, by reason that the Membrane was in some measure transparent. Some of the Feathers of the Wings and those which did make the Crest, were included in this Membranous Quill, which is likewise found in the Feathers of the Tail of *Turkey-Hens*. All the Thighs were covered with Feathers.

The Neck was nine Inches long. From the under part of the Belly to the extremitie of the Feet extended were fourteen Inches. The Feet were great and strong. The Legs were covered before and behind with large square Scales. At the sides they were small, not exceeding half a Line, of an *Hexagonal Figure*. The Talons were black, long, and crooked. Behind the Legg there wanted that Spurr which is peculiar to *Cocks*.

The Beak was large, being nine Lines broad at its beginning, and two Inches long. Towards the end it was black, and very hard; the rest was yellow and covered with a Membrane, which was so swelled in one of the Subjects, that it made a round and high Bunch, about the bigness of a small Nutt, and after the manner as *Albrechtus* Figures it. That which had not this Bunch had the end of the Beak divided in three, as if it had been three Beaks joyned together.

The Liver in both the Subjects, was of a brisk red Colour, and of a Substance very soft. It was divided into two Lobes: the right was biggest, the left longest. The Gall-Bladder was almost in the middle of the two Lobes, but more fastened to the left side than the right. In one of the Subjects it was *Anfractuans*, and of the Figure which is attributed to *Tears*; which divided it into three little Cells. It was joyned at the top to the surface of the Liver, by the means of its exterior *Tunic*, which it borrowed from the *Capsula*, and at the bottom to the *Intestine*, which supplies the place of the *Jejunum*. Its Colour was green, its length an Inch, and its bigness half an Inch.

The *Ductus Cysticus* in this Subject, proceeded from the upper part of the Bladder, and descended straight downwards, to insert it self into the Posterior part of the *Intestine*: It was about the bigness of a *Hens-quill*, and about an Inch long. There were two *Ductus Hepatici*, which in Birds is very rare. They both came out of the side of the *Vena Porta*. They were of different sizes, the one being as bigg as the Quill of a *Hen*, and the other scarce-

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scarcely equalling a middle sized pin. They descended in a right Line the length of an Inch, and penetrated the *Intestine* very near the insertion of the *Cysticus*.

In the other Subject the *Bladder* was smaller, of an oval Figure: The *Ductus Cysticus* proceeded from the middle of the *Bladder*. There were likewise two *Ductus Hepatici*, which were inserted into the *Intestine* after the same manner as in the other Subject: But all these *Ductus biliaris* were lesser than in the Subject where the *Bladder* was *Anfractuosa*.

The *Pancreas* which was found double in one of the Subjects, was placed as usually in Birth, in the Interval of the first Circumvolution of the *Intestines*, which makes a *Sinuosities*, at the bottom of which these two *Pancreas's* took their *Origine*; and the one, viz. the right, passing under the *Mesentery*, and the other above, ascended to fasten themselves to the left part of the *Liver*, and to the *Pylorus*. From this place they did each send forth a very fine *Ductus*, six Lines long, which inserted it self near the place of the three *Cholodochi*. These five holes wherewith the *Intestine* was in this place pierced by the three *Cholodochi* and two *Pancreatici*, did all meet under the wrinkle, which the *Intestine* makes, to form as it were a *Caruncle*. The glandulous Substance of the *Pancreas* was of a pale red: they were thin towards their *Origine*, but very thick at their extremity towards the *Liver*. The other Subject had but one *Pancreas*, and one single *Ductus*.

The *Oesophagus*, which was very strait, and not exceeding half an Inch in compass, was dilated towards the entrance of the *Thorax*, to forme a *Cram* which was four Inches in circuit, and an Inch in length. After its being thus dilated, it was contracted, and passing through the *Thorax*, was again dilated to form as it were a *Ventricle*, furnished with *Glands* which had the Figure and size of a grain of *Rye*: they were ranged like those which are described in the *Bustard*. The fleshy *Tunicle* of this *Ventricle* was very thin. The *Gizzard*, which was two Inches and a half in length, and two in breadth, had nothing remarkable, excepting that its fleshy part was very thin, and its Velvet covering very thick, hard, and brittle like *Glass*. This hardness hapning to this coat of the *Gizzard* of the *Indian Cocks*, when being separated from the *Gizzard*, they are left some time a drying; but in these Subjects, they were found thus hardened at the opening of the *Boddy*, and being still fresh.

The *Intestines* were of an extraordinary length, viz. twelve Foot; and each *Cacum* six; but their Cavitie was very strait, not exceeding a Line in Diameter. In the *Anus*, at the extremitie of the *Rectum*, there was a hole two Lines broad, which was the mouth of a Sack five Lines in length, and three in breadth. This Sack which was under the *Rectum*, is described in the *Bustard*.

The *Testicles* were seated on the *Aorta*, at the superiour part of the *Kidneys*: their Substance was glandulous, of a pale red. They were five Lines long and two broad; and at their lower part there was seen another Gland absolutely black, which was strongly fastened to them: 'Twas the *Epididymis*, which through its lower extremitie sent forth a very fine *Ductus*, which was the *Deferens*, which running along the *Vena Emulgens*, was changed into a very thin *Tunicle*.

The *Penis* was placed at the lower part of the *Anus*, opposite to the Rump. Its Figure was *Pyramidal*, being four Lines long, and three Lines broad towards its *Basis*. It was composed of two hard and nervous Bodies, clad with several smooth and spongy Membranes. There was also seen some muscous Flesh, which fastens it self at its *Basis*.

The *Kidneys*, which were speckled with several small points, some white, others minime, made us to apprehend that their Substance consists of a number of conglomerated Glands. They were, as usually in Birds, cut in several deep compartments and divisions, each *Kidney* being two Inches and a half in length and ten in breadth. The *Amblygonic Vessels* and *Arteries* had their distribution as ordinarily, and the *Venae* inserted themselves at the extremity of the *Rectum*, after having run along the exterior surface of the *Kidney*.

The *Affera Arteria* in one of the Subjects descended in a straight line to the middle of the *Clap Bone*, which terminates the top of the *Thorax* in Birds, where it was dilated and fastened. There turning it self backwards, it made a fold reaching an Inch and half in height, and fastening it self by a very strong Membrane to the very place of the *Cran Bone*. From thence it descended into the *Thorax*. In the other Subject it made not so great a fold, but it was dilated after the same manner. This dilatation was two Inches and a half in Circumference, being not an Inch in any other part.

The *Heart* was very small, not being an Inch in length and half an Inch at its *Basis*. Its point was very sharp. The Cavity of the *Bellu Pulva* which is at the mouth of the *Kidney* in Birds, was a Line in depth.

The *Globe* of the *Eye* measured ten Lines in Diameter, and the *Cornea* five. The *CrySTALLINE* was most convex behind than before: It was three Lines Diameter. The *Vitreous Humour* was of a very hard Consistence. The *Choroides* was all over black, even over the *Tapetum*, where were seen none of the Colours which are commonly there. The *Iris* was of a dark red. The *Sclerotica* was hard and Cartilaginous at the fore part, according to the nature of Birds and Fishes. The *Optick Nerve* was side-ways, and after having pierced the *Sclerotica* and *Choroides*, was enlarged, and formed a Circle, from the Circumference of which there went several black fillets, which were united to form a Membrane that we have found in all Birds, and which is described in several places of these *Memoires*.

The

The location of the figures of the Bullard.

There is a very real danger that the world will be divided into two camps: one in which the majority of the population will be able to afford a decent standard of living, and another in which the majority will be unable to do so. The danger is that the world will be divided into two camps: one in which the majority of the population will be able to afford a decent standard of living, and another in which the majority will be unable to do so.

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The Explication of the Figure of the Bustard.

THe Six *Bustards* were not in all things alike. There were some whose Neck was proportionably longer than the Leggs; others had it shorter. Some had the Beak more pointed than it is here described; yet the Generality had it thus. There was one where the Feathers which covered the Ear were somewhat longer than they are here represented.

In the Upper Figure.

- AA. *The two Lobes of the Liver.*
- B. *The Gall-Bladder.*
- C. *The Ductus Cysticus.*
- DD. *The Ductus Hepaticus.*
- EF *The Ductus Pancreatici.*
- G. *A fold of the internal Tunicle of the Intestine, forming a Caruncle or Teat, which cover's the four Mouthes of the Cystick, Hepatick, and Pancreatick Branches.*
- HH. *The Pancreas.*
- I. *The extremity of the Oesophagus where it begins to enlarge it self.*
- KKK. *The outward membrane of the Oesophagus which is common with the Oesophagus and Ventricle, or Gizzard which it covers.*
- LL. *The Internal Membrane which cover's the Gland's of the lower part of the Oesophagus. This Membrane is also covered with another which makes the Velvet, and which is likewise extended over the Membrane M M. It is not here represented, to avoid Confusion, and because it is easily supply'd by Imagination.*
- MM. *The Internal Membrane of the Gizzard, which is folded and rustled.*
- N. *The Glands which are at the bottom of the Oesophagus like to the ends of Pipes, and ranged one upon the other.*
- OO. *The Flefhy and Mulculous part of the Gizzard, inclosed between the Membrane K K K, and the Membrane M M.*
- P. *One of the Feet represented at large, altho it exceed not a third part of the Natural bignesse.*
- p. *One of the Talons cut, to shew that it is not hollow underneath, but round as at top.*
- Q. *The extremity of the Ilium.*
- RR. *The beginning of the two Cæcum's.*
- SS. *The great Pouch, which is near the Extremity of the Rectum. It is opened, to discover the mouths of the Ureter's and of the third Cæcum.*
- T T. *The Ureters.*
- V. *The third Cæcum commonly called Fabricius, Purse.*
- X. *The mouth of the third Cæcum.*
- Y. *A fold of the internal Membrane of the great Pouch of the Rectum, making a little Sack over the Mouth of the Purse.*
- Z Z. *The mouths of the Ureters.*

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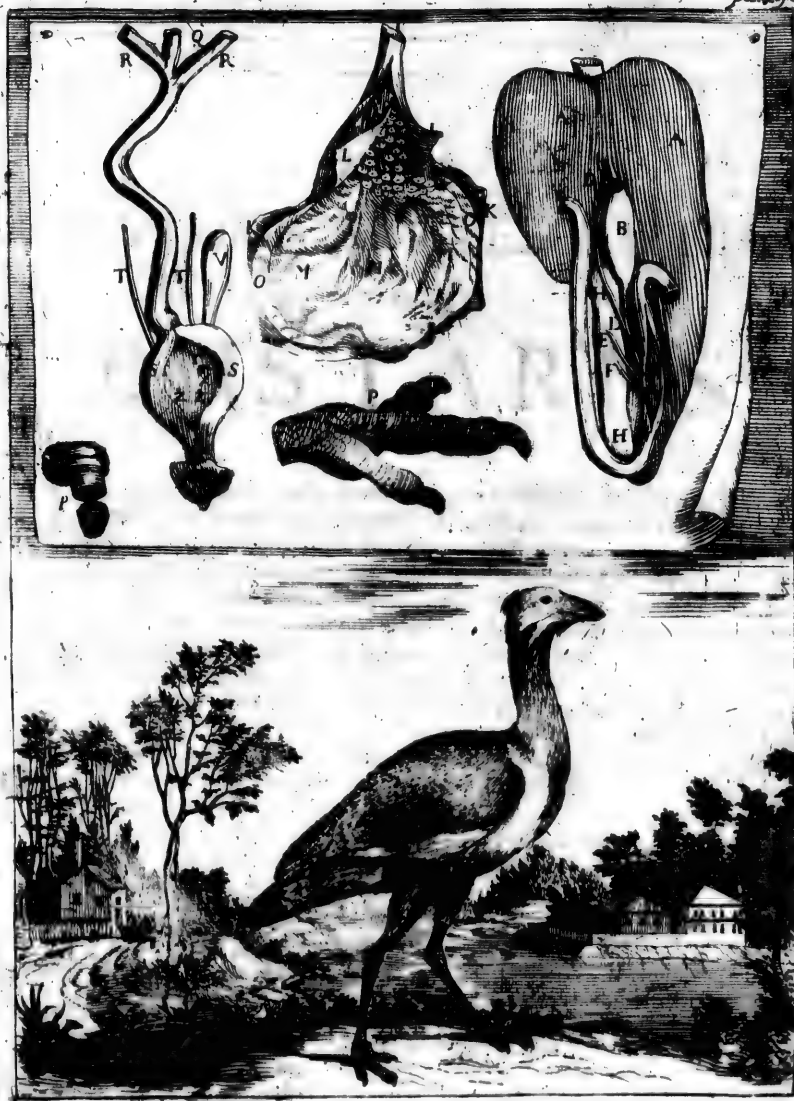
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T H E
ANATOMICAL DESCRIPTION
OF SIX
BUSTARDS.

THe greatest of the six *Bustards* which we dissected, comprehended but three Foot from the extremity of the Beak to that of the hind Feet extended. This size comes not near that which *Belonius* and *Turnerus* allow to the *Bustard*, which they report to be the largest of all Fowl next the *Ostrich*. The *Cassowary* and *Griffon* which we dissected, were a great deal bigger; and other Authors do not make the *Bustard* larger than that which we describe. *Aristotle* in *Athenaus* makes it much less; for he compares it, as to its bigness to a great Cock. And it is strange that *Belonius* and *Turnerus*, who had seen *Bustards*, should, to follow *Pliny*, speak so of it, that they seem not to have well understood him: For the Bird, which according to *Pliny*, is the largest next the *Ostrich*, is the second *Species* of *Tetrao*, which is not the *Bustard*; and *Pliny* says only that the bigness of the *Ostrich*, which is evidently our *Bustard*, approaches that of the *Tetrao*: But it is not certainly known what the *Tetrao* is, and what he speaks thereof agrees not at all with the *Bustard*; this Bird according to *Pliny's* Description, being black all over the Body, except the Feathers over the Eyes, which are red: which is not found in the *Bustard*, who has indeed some red and some black, or some brown in its Plumage, but these Colours are there placed after another fashion.

The Neck and Feet were much longer in our *Bustards*, than in those which *Gesner* and *Aldrovandus* have described: as for the rest they do well enough agree with the Description which these Authors do make thereof. Their Neck was a Foot long, and their Leggs a Foot and half. The Wings were hardly longer than the Leggs; so that being extended, they exceeded not four Foot; which has no proportion with the Mass of the rest of their Body. Therefore it is that this Bird fly's with so much difficulty that it may easily be overtaken in its flight. *Oppian* say's that of all Birds
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the *Bustard* only is afraid of Dogs, because that it raises it self so little from the ground, and goes so slowly, that they can easily catch it.

'Tis upon this account that it has been by the *Latins* called *Avi tarda*, from whence is derived the word *Otarde* in *French*, unless it be taken from its *Greek* Name, which is *Otis*; altho the Ancients have spoken very variously of the *Otis*, to make it doubted whether it is our *Bustard*. *Albertus* calls it *Bistarda*, and gives to that *Epithete*, ill borrowed from *Avi tarda*, an *Etymologie* much worse; for he thinks it is so named, because that it generally makes two leaps when it begins to fly.

The *Plumage* was of six Colours; viz. white, black, ash-colour, brown-gray, and rose-colour. The Belly, Thighs, under-part of the Tail, and Wings were white. It is probable that *Belonius*, who makes the top of the Wings white in the *Bustard* is mistaken; because that generally Birds which have any dark Colour in their Plumage, have it ordinarily on the Wings and Back: Which is observed in other Animals, which have the Back also browner than the Belly. The fore-part of the Neck, the Head, and middle of the upper part of the Wings were of an ash-colour. The hinder part of the Neck, the Back, the upper part of the Wings near the top, and the top of the Tail were red streak't with black, long, unequal, and as it were interrupted spots, as in *Partridges*. This made us to think that *Alian* intended to speak of the *Bustard*, when he says that in the *Indies* there are *Partridges* as bigg as *Geese*. The extremities of the Wings were of a dark-gray. All the Feathers in general, excepting the great ones, which are at the end of the Wings, had near the skin a down of a very lively red, inclining to a rose-colour. The Quill was also of this same Colour at the end. There were some of the Feathers which, (besides this Down fastened to the bottom of the Quill, had another, which after a very extraordinary manner, proceeded from their extremitie, the middle of the Feather being composed of firm Beards clasped to each other, as they are in Feathers which do serve for flying, and the rest being as it were splitt and divided into an infinite number of very small *Fibres*.

The *Beak* was of a somewhat darker-gray than the Plumage of the Head. It was three Inches long from the Eye to its extremitie. It had almost the shape of a *Turkey-hens* Beak, and resembled not, as *Gesner* reports, the Beak of the *Eagle*, which is very crooked.

The *Leggs* and almost half the *Thighs* were covered with little small Scales of an *Hexagonal* Figure, the greatest of which exceeded not one Line every way. The *Toes* of the Feet were covered at top with square, long and strait Scales. All the Scales were of an ash-colour, covered over again with a small Skin which was raised like the *Heckle* of a *Serpent*. The bottom of the *Foot* was covered with a Skin speckled like *Chagrine*. The *Toes* were in number only three. The hinder one was wanting, and in the place thereof, there was a *Callus* about the bigness of a small Nut. The greatest of the *Toes* was two Inches nine Lines long. The *Talons* were large, short, a little crooked, somewhat pointed, and almost like to the Nails of Man, being of an oval Figure: but what they had most remarkable, is that they were convex underneath as well as at top; which rendered their Section *Lenticular*. *Belonius* says that the kind of *Eagle* called *Haliaetos*, has its *Talons* round

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round underneath, as well as at top, contrary to the nature of the Claws of other Animals, which are hollow, or at least underneath.

The *Bustard* do's not build its Nest on Trees, according to *Albertus*, because it cannot fly : but it is probable that it is because it cannot stand there, by reason of the extraordinary make and structure of its feet, which is incommodious for that purpose, having no hind Toe, and the sole of the Foot being made round and filled with a great *Callosity*, which hinders it from being able to Perch.

Aristotle says that the *Otis* in *Scythia*, sits not on its Eggs like other Birds, but that it envelops and wrapps them up in a *Hares* or *Foxes* Skin, and hides them at the rooe of a Tree, at the top of which it Perches, to watch for the Fowlers, whom it hinders from approaching, by strikeing them with its Wings, as *Eagles* do : which demonstrates that the word *Otis* is very ambiguous amongst the Antients, and that it sometimes signifies our *Bustard* and sometimes another Bird, which is very different therefrom : for the *Bustard* is incapable either of Perching on a high Tree, or of fighting with the Fowlers.

The hole of the *Ear*, whose greatness some pretend has given the Name to this Bird, had nothing extraordinary. In some of our Subjects it was covered with Feathers somewhat longer than the rest : but they made not such long Ears as in the *Demoiselle* of *Numidia*, which, according to our conjectures, is the true *Otis* of the Antients, and that it is confounded with the *Otis*, as is shewn in the Description of the *Demoiselle* of *Numidia*.

The *Liver* was very large, the right *Lobe* in some of our Subject being five Inches ; so that it descended to the bottom of the Belly. It was of a firm Substance, and of a Vermilion Colour.

The *Gall-Bladder*, which was hid under the right *Lobe*, was fastened to the *Liver* only by its upper part, which was as it were its Neck : the rest hung down being loosened from the *Liver*, and adhering below to the *Jejunum*. It was two Inches and a half long, and an Inch broad, being of an oval Figure. The *Ductus Cysticus* in some of our Subjects was short, because that it proceeded from the bottom of the Bladder, and joyned it self to the upper part of the *Jejunum*. In others this *Ductus* was longer, because that it came from the the upper part of the Bladder, near its Neck, and was inserted into the same place as the others which were shorter. The *Ductus Hepaticus* came out near the Neck of the Bladder, and was also fixed to the *Jejunum*, two Inches lower than the *Cysticus*, only in the Subjects where the *Cysticus* proceeded from the Neck of the Bladder ; in others it was immediately inserted underneath the *Cysticus*, as it is commonly in Birds.

The Substance of the *Spleen* was quaggy, and of a dark red. It was made like the Kidney of *Terrestrial* Animal : it was only ten Lines long, and six broad.

The *Pancreas* was placed in the first Circumvolution of the *Intestines*, into which it descended as usually. Its Substance was hard, and of a pale red : it was very thin at one end and very thick at th'other, from whence its *Ductus* proceeded, which was but five Lines long. In one of our Subjects there was two *Ductus Pancreatici*, which came from the *Pancreas* : In another there were two *Pancreas*'s, which had each their *Ductus*. These *Ductus*'s

the *Cystici*, having each a separate entrance; but they were all covered with an Appendix like a Caruncle, which appeared to be a fold of the Internal Membrane of the *Intestine*.

Aristotle in *Athenaus*, remarks that the *Bustard* has no *Craw*. In our Subjects the *Oesophagus* was every where strait: it was enlarged only, and somewhat thickened before it joyned with the Gizzard, for about the space of two Inches. In this place there was a great quantity of Glands inclosed between the two Membranes of the *Oesophagus*. These Glands were ranged like Honey-Combs: each was pierced lengthwise, forming a little Tube or *Ductus*. The Figure of the whole Gland was Conical, and about the thickness of a Line at one end, and of the length of two, terminating in a point. These Glands were laid one upon the other, so that the great end only appeared, where was the mouth of the little *Ductus*. The internal Membrane of the *Oesophagus*, which was laid upon these small Glands, was so thin, that they were seen through it, and that when they were pressed, they sent forth a Liquor which likewise passed through the Membrane. This Membrane was also covered with another, which was extended over the whole Cavity of the Gizzard, as well as over that of the enlargement of the *Oesophagus* where the Glands were. This last Membrane supplied the place of the Velvet, which generally covers the inside of the *Ventricle* of Animals.

This Structure of the lower part of the *Oesophagus*, and this heap of Glands is found in most Birds, but is not commonly seen so plainly and distinctly as in the *Bustard*. *Arantius*, who has made the Dissection of a *Bustard*, calls these Glands of the *Oesophagus*, *Caruncule*; and says that they are round; but it is probable that he saw those Glands only through the Internal Membrane, which offers to view only the great end of each Gland, which is round; the rest, which is extended, and makes a point, being hid under the other Glands.

The *Gizzard* was four Inches long, and three broad. Before its opening it appeared very like to the Gizzard of Hens, by reason of its hardness, which in Hens proceeds from the thickness of the fleshy part: but in all our *Bustards*, this fleshy part was very thin, not exceeding a Line in thickness; and the whole hardness which was observed in this Gizzard before it was opened, proceeded solely from the Internal Membrane, which was not only thick and hard, but which had Folds and Ruffs in several manners; each Ruff being frizled and refolded, which took up a great deal of room.

This folded and ruffled Membrane on the inside of the Gizzard, was of a gold Colour, and had no continuity with the Membrane extended over the Glands of the *Craw* which was white; but it was separated from it like the Seams of a Lining of a Garment sowed together: It was likewise easily separable from the fleshy part of the Gizzard.

This *Gizzard* was filled with Stones and Doubles: There were some Stones about the bigness of a Nut. In one of the Subjects there was found ninety Doubles, worn and polish'd by their mutual rubbing, and by that of the Stones which were mix'd therewith, without any appearance of Corrosion; which it was easie to judge, for that they were worn only in their Gibbous

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and Eminent parts, the hollow parts remaining intire and without Polishing, because that they could not be touched and rubbed like the others. There was not likewise seen any mark or sign of Corrosion in these parts, being neither rusty, rough, nor uneven. In one of the Subjects the *Ventricle* was found filled with a great quantity of Hay. *Athenians* say's that *Bustards* do chew the Cud. In a *Parrot*, which is a Bird that is observed to Chew over again what it has already swallowed, we have remarked two *Ventricles* separated one from the other by a long *Ductus* or Passage, which seems to be made for the use of Ruminatio. But we have found no such thing in the *Bustard*.

The *Intestines* measured four Foot in length, without reckoning the two *Cacums*, of which the right was a Foot, and the left eleven Inches; which is no great length for an Animal that eats Hay. The two *Cacums* proceeded as usually from the place where the *Colon* is joyned to the *Ilium*, seven Inches distant from the *Anus*. They tended not from the top downwards, as *Arantius* reports he observed it; but from the bottom upwards, as it is found in other Birds. The internal Tunicle of the *Ilium* was folded lengthwise, after the manner of the last *Ventricle* of Animals which chew the Cud: towards the extremity of this *Intestine* it had some cross wrinkles which supple'd the place of the Valve of the *Colon*.

About an Inch distant from the *Anus*, the *Intestine* was contracted, and afterwards dilated, making a Pouch capable of containing an Egg. The two *Ureters* were inserted into this Pouch. Towards its middle there was discovered a little hole, which led into a Sack which was as it were a third *Cacum*, which is vulgarly called the *Purse* of *Fabritius*, from the name of him who first described it. This *Purse* or Sack was two Inches long, and three Lines broad at its beginning, where it was a little straiter than towards its extremity. Over the hole, which from the middle of the Pouch penetrated into the third *Cacum*, there was a fold of the internal Membrane of the Pouch, which served apparently for a Valve capable of hindering the reflux towards the top of the *Rectum*, and of favouring the entrance into the third *Cacum*.

This observation of a third *Cacum*, is contrary to what *Aristotle* has remark'd in the *Intestines* of the *Bustard*, which he reports to have less *Appendices* at their lower extremity, than other Birds use to have.

The *Kidneys* were three Inches long: They were very deeply cut in three Lobes, after the manner of Birds. Their Vessels were likewise disposed as in other Fowl, except the two *Crural Arteries*, which are generally double, and which commonly pass underneath the Kidneys: For in our Subjects there was one which passed over, and another which passed under, to go into the Thigh.

Each *Testicle* was six Lines long and two broad, being of the shape of a small Almond, of a Substance very firm, and white. The *Epididymis*, which was perfectly black, and of the same Figure of the *Testicle*, contained four Lines in length and two in breadth. Besides the two *Testicles*, in one of our Subjects there was found a Glandulous Body, which seem'd to be a third. It was nine Inches long, and six broad, of an Olive Colour. The *Ductus Deferens*, which proceeded from the extremity of the *Epididymis* of each of the

true *Testicles*, past over the *Vena Emulgens*, to which it was fastened, and descended upon the Kidney along the *Ureter*.

At the upper lip of the *Anus*, there was a little Appendix, which supplied the place of the *Penis*. Amongst so many Subjects of this Kind which we have dissected, there was never a Female.

The *Tongue* was not Bony, as *Aristotle* describes it in *Athenians*: It was Flethy on the outside, having on the inside a *Cartilage* fastened to the *Basis* of the *Os Hyoides*, as in the generallity of Birds. Its sides were rough with some prickly parts of a Substance between a Membrane and a *Cartilage*.

The *Rings* of the *Aspera Arteria* were entire. In some of the Subjects there was on each side a *Carcuncle* or red Gland, immediately fastened to the *Aspera Arteria*, and to the *Carotides*, by the means of a branch about the bigness of a great Pin; which is very common in Birds.

The *Heart* was two Inches and a half bigg. The Sack which formes the fleshy Valve, which is commonly found in the right *Ventricle* of the Heart of Birds, at the entrance of the *Vena Cava*, was four Lines deep. The flesh of the left *Ventricle* was four Lines thick towards its *Basis*, and one towards its Point.

In the Eye, the *Sclerotica* had a Cartilaginous edge before, about a Line broad, which made as it were a Circle about the *Cornea*. The *Uves* was reddish and overspread with a great number of Arterys, Veins and Nerves. The *Iris* was of an Isabella Colour. The *CrySTALLINE* was three Lines Diameter; the whole Globe of the Eye nine.

The *Optick Nerve* having penetrated into the inside of the Eye, was flattened, and formed a white edge of an oval, long and strait Figure; from whence proceeded the black Membrane in form of a Purse, which fastened it self to the side, towards the edge of the *CrySTALLINE*. This Membrane is more particularly described and represented in the Description of the *Ostrich*.

In the *Palate* and lower part of the Beak, which is as it were a lower Jaw, there was under the Membrane which covers these parts, several glandulous Bodys, which did open into the Cavity of the Mouth by several very visible Tubes.

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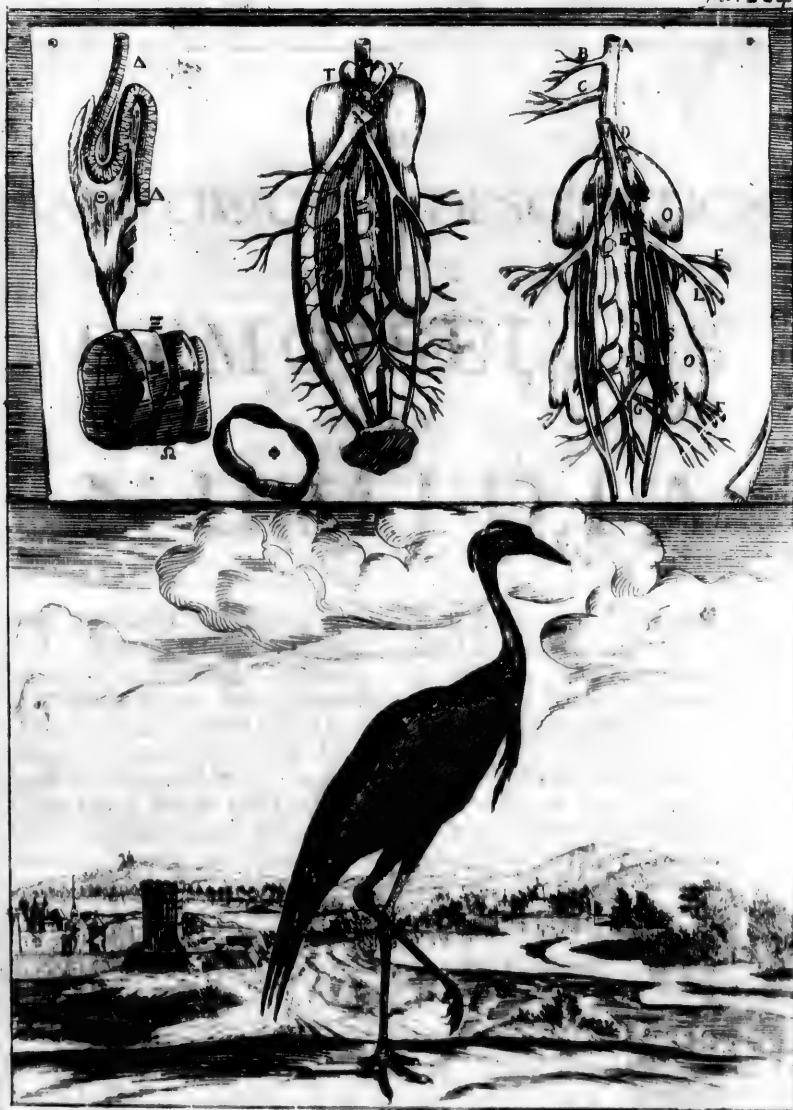
The Explication of the Figure of the Demoiselles of Numidia.

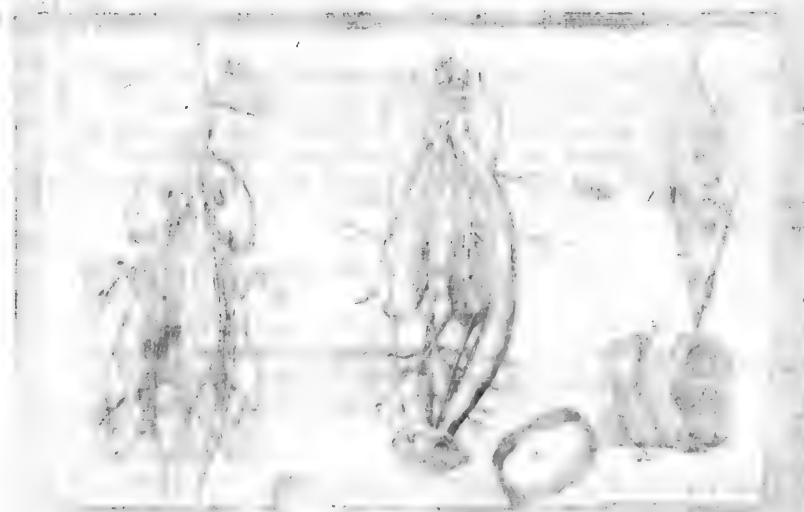
THe lower Figure represents what kind of long white Feathers do stand up like Ears on both sides of the Head of this Bird; and how the brown, long, and loose Feathers, do hang down to the bottom of the Neck. But that which is most remarkable, is the Posture, in which it is put, by representing it as if it danced; because that this Action is proper to it.

In the Upper Figure.

- A. *The Trunk of the Aorta.*
- B. *The Arteria Cœliaca which goes to the Ventricle, Splcen, and Liver.*
- C. *The Mesenterica, which goes to the Pancreas and Intestines.*
- D D D. *The Arteriæ Emulgentes.*
- E E. *The Cruralis Superior.*
- F F. *The Cruralis Inferior.*
- G. *The extremity of the Aorta which is distributed to the Os Sacrum and the adjoining Parts.*
- H. *The Trunk of the Vena Cava.*
- I. *The Ramus Iliacus of the Cava.*
- K. *The Vena Emulgens.*
- L. *The Vena Cruralis.*
- M. *The Trunk of the Cruralis which passes under the Kidney, and joyns at N to its fellow.*
- O O. *The left Kidney.*
- P. *The Testicle of the Male.*
- Q. *The Epididymis.*
- R R. *The Vala Spermatica Deferentia.*
- S. *The Ureter.*
- T. *The Testicle of the Female.*
- V. *The Ovarium.*
- X Y. *The Oviductus.*
- X. *The Funnel of the Oviductus.*
- Z. *A Ligament which fastens the Oviduct to the Kidney, like a Mesentery.*
- Δ Δ. *The bending of the Aspera Arteria.*
- Θ. *The Bone of the Sternum, in which the Circumvolution of the Aspera Arteria is held fast.*
- Φ. *One of the Rings of the Aspera Arteria having two Notches.*
- Ξ Ω. *A Piece of the Aspera Arteria which discovers the manner how its Rings are interwoven.*
- Ξ. *The Part which respects the Vertebrae of the Neck.*
- Ω. *The Part which respects the outside of the Neck.*

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THE
ANATOMICAL DESCRIPTION
OF SIX
DEMOISELLES
OF
NUMIDIA.

THis Bird is so called, by reason of certain ways of Acting that it has, wherein it seems to imitate the Gestures of a Woman, who affects a Grace in her Walking, Obeissances, and Dancing. This resemblance must be thought to have some reasonable ground, seeing that for above two Thousand Years the Authors which according to our Conjectures, have treated of this Bird, have designed it by this Particularity of the imitation of the Gestures and Behaviours of Man. *Aristotle* gives to it the Name of *Actor* or *Comedian*. *Pliny* calls it *Parasite* and *Danser*. *Athenens* Names it *Aspionchis*, that is to say, having humane Form, by reason that it imitates what it sees Men do, and not because that it imitates the Speech of Man like the *Parrot*, as *Gellius* understands it. For *Athenens* relates the manner, which as *Xenophon* reports it, the Fowlers make use of to take these Birds, which is by rubbing their Eyes in their Presence, with Water put into Vessels which they do carry away, leaving such like Vessels filled with Glue, wherewith these Birds do glue their Feet and Eyes, when they endeavour to imitate what they have seen other done.

It is probable that this *Dancing* or *Ruffoon* Bird, was rare amongst the Ancients, because *Pliny* thinks it fabulous, by ranging this Animal, which he calls *Satyrick*, amongst the *Pegasus's*, *Griffons*, and *Siren's*. It is likewise credible, that till this time it was unknown to the Moderns, seeing that they have not spoke thereof as having seen it, but only as having read in the Writings

tings of the Ancients the Description of a Bird called by the *Greeks*, *Scops* and *Otus*, and by the *Latins* *Asio*, to which they had given the Name of *Danser*, *Actor*, and *Comedian*. So that the Matter in Question is to see whether our *Demoisells* of *Numidia* may pass for the *Scops* of the Ancients.

The Description which they have left us of the *Otus* or *Scops* consists in three remarkable Particulars, which are seen in the *Demoiselle* of *Numidia*, altho' it is not found that any of the Moderns have described it, and that it has relation to any of the Birds whereof the Ancients have spoken. These three Particulars, are the extraordinary Postures which all Authors do attribute unto it, and which have made it to be called *Scops*, from *σκόπειν*, which according to *Athenæus*, sometimes signifies to make Sport, in imitating the Gestures of any one: And the same Author says, that *Scops* was a kind of Dance so called, by reason of the Bird *Scops*, which was as it were, the Inventor thereof. The second Particularity, by which *Aristotle* and *Pliny* have designed this Bird, consists in some feathered Eminencies, which they do put on both sides of the Head, in the manner of great Ears. The third is the colour of its Plumage, which *Alexander Myndicus* in *Arbæus*, declares to be Blewish, and of a Lead-colour: to which it must also be added, that they do say, that this Bird is of *Africk*.

There is none of those that have seen the *Demoiselles* of *Numidia*, in the Park of *Versailles*, who have not observed their Gate, Gestures, and Leaps, to have a great deal of Relation to the *Bohemian* Manner, whose *Danse* they seem to imitate. And it might be said, that they are mainly pleased to shew their Graceful and handfom Disposition for leaping, and that they do follow People, not to have what is thrown to them to eat, as commonly do Savage Animals when they are tamed, but to be taken Notice of; never failing, when they see that they are lookt upon, to fall a Dancing and Singing.

All that we dissected had the feathered Ears, which have given the Name to the *Otus* of the Ancients. These were Appendices three Inches and a half long, composed of white Feathers, made of fine long Fibres, after the manner of the Feathers that young *Herons* have on the Back near the Wings. All the rest of the Plumage was of a leaden Gray, such as it is described by *Alexander Myndicus* in the *Otus*; except only some great Feathers of the Wings which were of a darker gray, and that part of the Feather which appears, and some Feathers of the Head and Neck: But for all this, the Plumage in general may pass for a lead Colour.

In some of our Subjects, the Head had on its Crown some Plumes erected like a Crest, an Inch and a half long. These Feathers were of this leaden Gray, which was prevalent over all the Body. In all of them, the sides and hinder-part of the Head were garnished with black and shorter Feathers than the rest. From the *Canthus* or Corner of each Eye, there went a streak of white Feathers, that passed under the Appendix, which formed the great feathered Ears. The fore-part of the Neck was adorned with black Feathers, composed of long Fibres, much finer and softer than those of the *Crest* *Heron*; they hung down upon the Stomach about Nine Inches long, with a very great Grace and Decorum.

From the end of the Beak to the extremity of the Legs extended there were three Foot and a half. The Beak measured two Inches in length; it

was

was strait and pointed. The Neck was fourteen Inches. From the Thigh Bone to the extremity of the greatest Toe, was ten Inches.

The Eyes were large, having the Eye-lids black. The internal Eye-lid was white, interspersed with a great many blood Vessels.

The Legs were covered on the fore-side with great Scales, which were five Lines long and four broad: on the inside they were garnished with small Scales of an Hexagonal Figure. The sole of the foot was speckled like *Chagrin*. The Talons were black, and moderately crooked. The greatest Toe, which was that of the middle, had four *Phalanges*; the least which was on the outside had five; the middling one that was on the inside, three; that behind but one.

The Liver was so large in one of our Subjects, that it filled almost the whole capacity of the lower Belly. In the rest the right Lobe was only four inches in length, and the left three. In this Lobe which covered the *Gizzard*, there was a Cavity to receive the Anterior part thereof, which was sharp, making as it were an edge. In four of our Subjects the Liver was Scirrhus being filled with a great quantity of small yellow grains, like to *Millet*. This Scirrhus Constitution did in some measure intimate to us that these Livers were composed, as it were, of several small Lobes, each likewise composed by the conglomerating of several Glands. It was also seen after what manner the *Rami Capillares* of the *Vena Porta*, *Cava* and *Ductus Biliarii*, went into each of the Lobes; and it might be judged that there were some which were distributed to each of the Glands, because that having blown into these *Ductus's*, it was observed that in the Livers, which were not yet quite hardened, the little Lobes, and even the minute Glands, whereof the small Lobes are composed, were sometimes raised together, and sometimes apart. In fine, as the found Livers seemed to have a Substance homogeneous and continued, by reason of the softness which is equal in all the parts that constitute their *Parenchyma*; they do also appear composed of several distinct and separate parts, which we call Lobes, composed likewise of Glands, in those that have been hardened by Distemper, by reason that this Induration not equally prevailing over all the parts, shews their distinction: the *Interstices* of the Lobes and Glands being softer, by reason of some remainder of Blood in these *Interstices*, of which the Glands were destitute. It must be nevertheless granted that the Experiment, by which different parts were seen separately to rise upon blowing into the Vessels which are distributed to the different Lobes of the Liver, affords a Conjecture more certain, to conclude that the substance of these *Viscera* is Glandulous, and that it is not from the different Consistence which the Scirrhus disposition causes in the Liver; and tho' it frequently happens that the Spleen, when it is Scirrhus, discovers some hardened Graines, like those which are in the Scirrhus Liver, yet it is certain that the Spleen is not Glandulous like the Liver: for this may cause a belief that this Argument is equivocal, and that these Graines may be produced as well by some obstructions which do stop the passages, such as are those of the Spleen, as by the Induration of the Glands, such as are those whereof the Liver is composed.

We found no Gall-Bladder in two of our Subjects; in the other it was small, of an oval Figure, not exceeding five lines in length and four in breadth.

It

It was fastened to the right Lobe by its Neck, the rest being loose and pendent. The *Ductus Cysticus* proceeded near the Neck, and was joyned to the *Jejunum* being a line in thickness, and four inches four lines in length: the *Hepaticus* came out of the Liver lower than the Gall-Bladder, and was but two inches long: it was inserted near the *Cysticus*.

The *Spleen* was of a Substance very like to that of the Liver, seeming to be composed of Lobes and Glands, and being Scirrhus. Its Figure resembled that of the Kidneys of Terrestrial Animals, the *Splenatick Vessels* entering through its gibbous part, after the same manner as the *Emulgents* do enter into the Kidneys. It was seated above the left Kidney, and between the two Lobes of the Liver, so that it appeared to be a third Lobe. It was united to the second *Ventricle* by the means of a Membrane that held the *Splenatick Branches*.

At the bottom of the *Oesophagus*, where it began to dilate, there were two Glands, three lines long, of an oval Figure, red and with a Cavity in their middle: They were fastened to some branches of the Nerves of the sixth pair. The *Oesophagus* was dilated towards the bottom, to make a *Cran* about fifteen lines Diameter, and six inches long. Its lower part, which was two inches long, was of a substance different from the superior, its external Membrane being thicker and more fleshy, and having between this and the internal Membrane several little Glands regularly ranged one by the other, as they are seen in several Birds, and as it is described and Figured in the *Bustard*.

The *Gizzard* measured two inches and a half in length, and two in breadth. It was very like to that of a *Hen*, having a thick and hard Flesh. It was different therefrom in its interior Membrane, which was yellow, hard, and almost all separated from the fleshy part. This Membrane being dried did break like Glass, as it did in the *Indian Cock*. In one of our Subjects there was found in the *Gizzard* several Scents, which seemed to be worn by their mutual rubbing.

The *Intestines* were six foot long, and two lines broad. Their Coats were extraordinary thin. Each *Cacum* measured six inches in length. The *Rectum* was dilated towards its extremity, where it had a very ample Cavity, into which the *Ureters* with the *Vasa Spermatica Deferentia* opened, in the Male: in the Females the *Ureters* with the Passage called *Oviductus*, which is their *Matrix*, had likewise their Mouth in this place.

There were two *Pancreas*'s of unequal length, the right being five inches and the left four. They were fastened to the *Mesentery*, which afforded them store of very visible Vessels. Their Substance was soft, and so light, that the two together weighed but one Drachme. The *Ductus Pancreatici* proceeded from their upper part. The right *Ductus* was ten lines; the left but eight. Altho they were inserted in two different places, their mouths were on the inside very near each other, and adjoining to the mouth of the *Ductus Biliaris*, they were closed again with the same *Caruncle* as usually.

The *Testicles* measured six lines in length and four in breadth: they were immediately connected to the Trunk of the *Aorta* and *Cava*, being seated towards the upper part of the *Kidneys*. They had an *Epididymis* loose from the *Testicle*, which hung by one end. It was five lines long, of a green colour, the *Testicle* being of a whitish-yellow. The *Ductus Deferens* proceeded

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not from the *Epididymis*, but from the lower part of the *Testicle*, from whence descending along the *Vena Emulgens*, it was fastned to the *Ureter*, so that the *Ureter* and *Deferens* made but one *Ductus*.

The Females had *Testicles* like those of the Males, except the *Epididymis* which was wanting. Immediately underneath the *Testicles* the *Ovarium* was placed. 'Twas a heap of a great number of little Eggs different in size, some being as big as little Pease, others as small as Rape-seeds. The passage called *Oviductus*, that seems to have relation to the Part called *Tuba* in the *Murix* of Terrestrial Animals, was enlarged at the top like a Funnel which embraced part of the Eggs. This Funnel which represents the Fringe of the *Tuba* of Terrestrial Animals, was made of a very fine Membrane; the rest of the Passage, whose Membrane was a little thicker, descended along the left Kidney, to which it was fastned by the means of a Membranous Ligament, an inch broad, in form of a *Mesentery*, which grew along the *Vena Emulgens*, from which it received several branches, which connected with the branches of the *Emulgent Arteries*, were dispersed in the Membranes whereof this Ligament was composed, and did likewise pass into the *Tupicks* of the Passage called *Oviductus*. This Passage, which was very streight in its upper part, was greatly enlarged towards the bottom, where it opened into the extremity of the *Rectum*, with a very streight Mouth.

The *Kidneys* were three inches long and seven or eight Lines broad, being indented in several places after the usual manner of Birds. The *Vasa Emulgentia*, viz. the Vein and Artery, were of a Structure very different. The trunk of the *Aorta* descending directly, without dividing into two other trunks, did plainly shoot forth on the right and left some branches of a mean size. The first, third, and fourth, which were the least, did enter into the *Kidney*, and made the *Emulgents*. The second, and fifth, which were bigger, were the *Crunal Arteries*. The sixth and seventh were lost in the lower part of the Belly. The trunk of the *Vena Cava* having passed a little underneath the beginning of the *Kidneys*, was divided into two great Branches, each of which was again subdivided into two others: the one of these branches run along the Kidney, and was there fastened by several very short branches, which were the *Emulgents*. The other Branch was likewise divided into two others, one of which did also make the *Vena Cruralis*: the other passing underneath the Kidney, joyned it self to the opposite branch; and both made but one branch laid upon the Artery, which was divided like the Vein, and was distributed as the other into the lower parts of the Belly.

The *Ureter* proceeding from the upper part of the Kidney, went under the branch of the *Vena Cava*; and running along the Kidney, joyned it self with the *Deferens*, to make together but one single Vessel, as has been declared.

The *Larynx* was composed of a *Cricoides*, and *Arytaenoides* as in the Goose.

The Rings of the *Aspera Arteria* were intire, of a very hard substance, near that of a Bone. Their Figure was particular, each being notched and indented in two places, and joyned together by this Notch, viz. at the places which did answer to the two sides of the Neck: the rest, which was not notched, being foreward and backward, so that the notches of one Ring entering into the notches of the other, it happened that the rest of the Rings

which were not notched, did on the fore-part cover the halves of two Rings, and was covered behind with those very Rings which it covers in the fore-part. This Structure made these Rings to enter into each other, which they could not do very far, being hindered by these Notches, which made one Ring to ride over the other, and made the Artery, that it could not bend so easily towards the sides, as forwards and backwards, where there was nothing that might hinder the Rings from entering into each other.

The Figure of the whole Artery was not less strange than its Composition: for after having descended along the Neck in a strait line about the length of a foot, it turned outwards; and instead of entering into the Thorax, it did enter into a hollow Cavity in the Bone of the Sternum, where being descended about three inches, it was re-bent towards the place through which it had entered, and from thence descended into the Thorax, where it was divided into its two Branches. The Rings in this whole Circumvolution were so strongly fastened to each other, that they were not capable of any Motion: neither have they any need thereof, being thus inclosed within the Sternum. The Rings of the part which was in the Neck were looser, to yield to the motion of the Neck.

At the bottom of the *Aspera Arteria*, there was a bony knot, having the form of a Larynx, which on the inside was divided in two by a small Tongue, as in the Goose and several other Birds. The Branches which went to the Lungs were likewise, according to the usual manner, composed of Cartilaginous Demi-Circles at the top, being garnished underneath only with a very thin Membrane. The round and long Muscles which in several Birds do fasten the *Aspera Arteria* with the Sternum, did take their Rise from that part of the Sternum which is Articulated with the Clavicula or forked bone, and were inserted into the sides of the *Aspera Arteria* a great deal higher than the place of their Origine, so that their Action was to draw the *Aspera Arteria* downwards. They were a line and a half in Diameter, and near two Inches in length.

When the *Aspera Arteria* was blown into, the Bladders of the Lungs which descended to the bottom of the Belly, did swell and raised up the Liver. At the same time that the Bladders were swelled, the Oesophagus and Crop were likewise observed to swell as in Pigeons; and when the Oesophagus was breathed into, the Bladders did also rise; but the Air did more easily pass from the *Aspera Arteria* into the Oesophagus, than from the Oesophagus into the *Aspera Arteria*. The use of this Communication, and the ways by which it is performed, are not as yet well known: we refer the speaking thereof to the Description of the Pigeon.

The Heart was two inches long and an inch broad at its basis: it weighed half an ounce. The Pericardium was fastened to the Heart by several small Fibres. The right Ventricle was, as usually, larger than it is long. Its Interior was extraordinary Smooth. The fleshy Valve which Birds have at the mouth of the *Vena Cava*, was five lines long, and half a line thick. The Arteries of the Heart had their *Valvulae Sigmoides*, as usually. The Fleishy Ligament which fastened one of the Partitions of the right Ventricle to the other, was longer and thinner than generally it is.

The

The *Aorta*, coming out of the Heart, was divided into three Trunks. The least was the *Aorta descendens* which made the *Croffe*, by turning towards the right side as in the Generality of Birds. The two other greater Trunks were the *Axillares*, which having cast forth two small Branches, which were the *Carotides*, were divided into several other great Branches, which were almost all employed and distributed into the Muscles of the Wings. The *Carotides* a little above their Origine, had each a Gland, which was fastned to them. These Glands were two lines long, and a line thick.

In the lower Beak on both sides of the Tongue, under the inward Tunicle of the Mouth, there was found two Glandulous Bodies, from whence proceeded several *Lympheducts* which opened into the Mouth, and there discharged, being squeezed, a white and Viscous humour. There were two of them towards the upper part a great deal bigger than the others. The Tongue was fleshy at top, and Cartilaginous underneath as in *Hens*.

The Tunicle of the Palate was rough, with a great number of little Nipples, and of hard and Membranous points. It likewise included a glandulous Body, which shot forth two great *Ductus's* opening into the Mouth. There was discovered a great quantity of other little glands at the sides of the *Larynx*, which had also some *Lympheducts*.

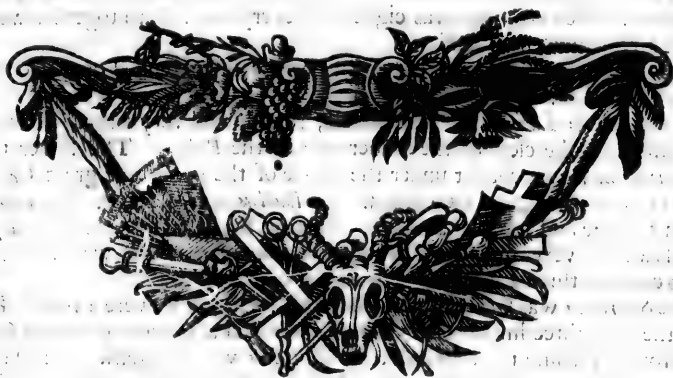
The *Cranium* or Skull was above half a Line thick. The Brain was divided in two, as generally in Birds. Each part was eleven lines long, and seven broad. The *Cerebellum* was eight lines every way. Both together weighed but a Drachme and a half.

The internal Eye-lid was large, and was easily extended over the whole Globe of the Eye.

The *Punctum Lachrymale* was double, round, and very large. It opened as is usual into the cleft of the hinder part of the Palate. The lower *Glandula Lachrymalis* was coucht under the Globe of the Eye in the great *Canthus*. It was ten lines long and two broad. Its *Ductus* was great, and opened between the Eye and internal Eye-Lid. Having Syringed into this *Ductus*, the Gland swelled very much. The upper *Glandula Lachrymalis* was very small not exceeding three Lines in length and two in breadth.

The *Sclerotica* was Cartilaginous before, having as it were a harder Ring than the rest, three lines broad. The *Cornea* had a border or yellow Circle quite round, joyning the *Conjunctiva*. The *Iris* was of a dark red: the *Tapetum* of the same colour; the rest of the *Choroides* was extraordinary black, We found not that other black Membrane like a Sack, which proceeds from the *Optick Nerve*, and which we have always found in the Birds that we have dissected, without being able to conjecture what its use may be. All that we could surmise is, that this part has an Office like to that of the *Choroides*, in that the one and the other do, amongst other things, serve to prepare the Nourishment of the Humours of the Eye; which, by reason of the transparent purity that is requisite for them, must have an Aliment very pure, and wholly exempt from the gross and Earthy parts, by which Bodies are rendered Opake: for these parts, which may be called the Loos of the Blood, are separated therefrom, and retained in the *Choroides* and Purse of the *Optick Nerve*, which are sullied and blackned therewith; this being done almost after the same manner as the *Choroides*, *Placenta*, and Membrane of the *Uterus*

are sullied, if I may so say, from the grossest and most impure portion of the Blood which they retain, to the end that the part designed for the Formation and Nourishment of the *Fetus* may be finer and purer. This Conjecture which for these reasons may have some probability, has been likewise confirmed by the particularity that we have remarked in our Subject; where this black Purse not appearing, we found the *Choroides* a great deal thicker than ordinary; as if the whole dregs of the blood, which in the Eyes of other Birds should be retained in the *Choroides* and black Purse, had here been collected into the *Choroides* alone.



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The Explication of the Figure of the OSTRICH.

IN the lower Figure it may be seen that the Feathers of the Wings and Tail could not be proper for Flying, the parts which do compose these Feathers not being hook'd together as they are in other Birds; that the Eye, which is not obliquely Scituated after the usual manner, has great Eye-lids, The opening of which is long-wise as in Man; that the Neck, Head, and Thighs are destitute and unprovided of Feathers, and that each Foot has but two Toes.

In the Upper Figure.

- A A. Represents the Cavity of the middle of the Thorax.
 B B D D. The Cavity of the lower Belly. These two Cavities are formed by two great Diaphragms, and separated one from the other by the transverse Diaphragme which is between A and B, and which is garnished with Fat underneath.
 E E E E. The four Bladders of the right side of the Stomach.
 C C C C. The four Bladders of the left side. These four Bladders are inclosed on each side between the great Diaphragme and Muscle of the Lungs.
 G G. The Lungs, each of which is shut up between the Muscle of the Lungs, and the Ribbs.
 H. A part of the Cartilago Cricoides,
 I I. The Cartilago Tyroides.
 K. The Tongue.
 L L L. The hinder part of the Sclerotica, which makes half the Globe of the Eye; the fore-part being taken away.
 M. The Membrane folded like a Purse, which proceeds from the Infundibulum or Funnel N, formed by the extremity of the Optick Nerve, and uniting near the Ligamentum Ciliare.
 O. The Optick Nerve.
 P. The Crystallinus with the Ligamentum Ciliare.
 Q Q. The Cerebrum uncovered.
 R R. The Dura mater raised up and thrown backward, upon the Cerebellum.
 S. The Glandula Pinealis in its place.
 T T. The upper part of the Cerebellum.
 V V. The Sinus Longitudinalis.
 X X. Two Tuberosities or Swellings, making the lateral and inferiour parts of the Cerebellum.
 Y Y. Two Cavities or Ventricles which are in the Swellings of the Cerebellum.
 α. The Cavity which is at the rise of the Medulla Spinalis made like a Pen.
 β. The Vermiforme Apophytis of the Cerebellum,
 γ. The Cerebellum raised, and turned backwards.
 δ δ. The Brain divided in two, after having cut the small Fibres which joyn the two parts.

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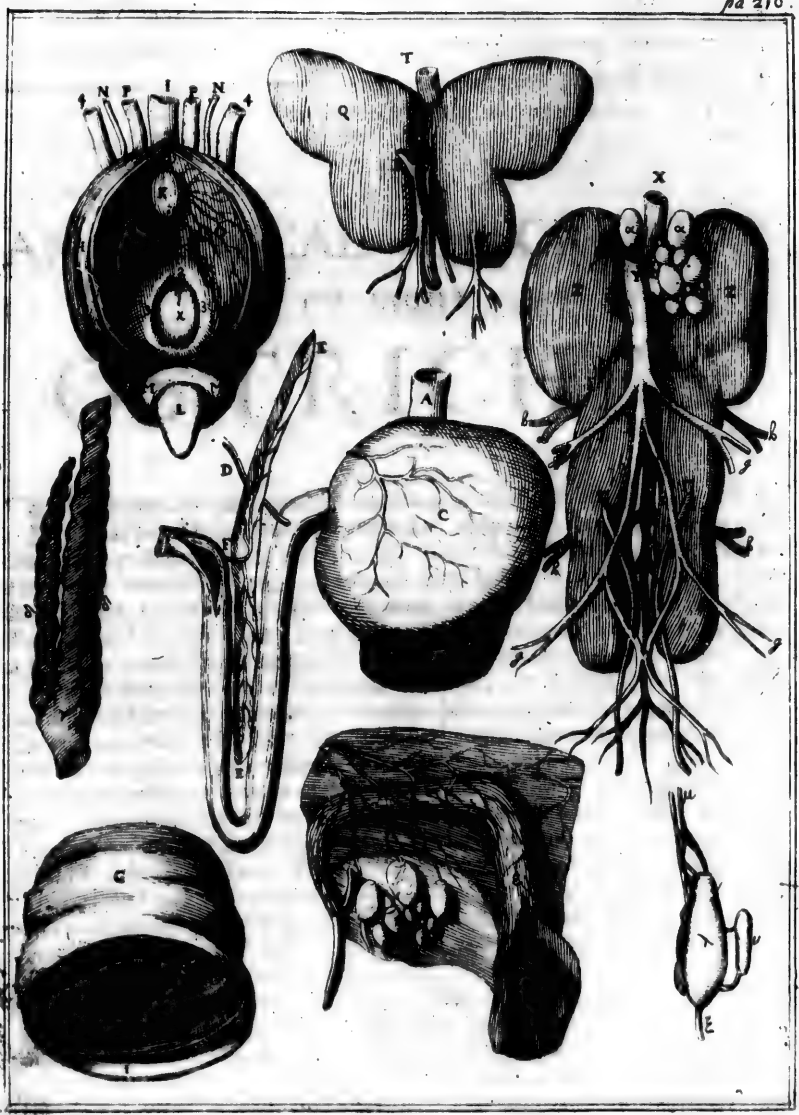


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- ζ. The upper Ventricles in which is seen the Lacis Choroides marked ζ.
 ι. The Glandula Pinealis bent a little backward out of its place.
 λλ. Two Swellings Scituated under the Brain. They are the same which are marked XX.
 μ. The Cerebellum.
 ν. The fourth Sinus.
 Δ. A piece of the Stem of a Feather viewed with the Microscope.
 11. 22. Two of the Filaments whereof the left Beard of the Feather was composed. Here is represented only the beginning, the rest being cut off: they are garnished on each side with a row of Fibres.
 ZZ. The Fibres which are at the side, toward the end of the whole Feather; these Fibres having several small Crochets or hooks bent downward, which are like a Latch, according to the comparison that is made thereof in the Description.
 ΘΘ. The Fibres which are at the sides towards the hollow of the Feather; these Fibres have several little Hooks bent upwards, resembling the Catch to which the Latch is fastned, when it is pushed forward enough to fall into the Catch.

The Explication of the Second Plate of the OSTRICH.

- A. Is the Oesophagus.
 B. The Bottom of the Craw, which descends underneath the Gizzard.
 C. The Gizzard.
 D. The Ductus Hepaticus.
 E. The Pancreas.
 F. The Ductus Pancreaticus, whose Aperture into the Intestine is marked c.
 G. A part of the Colon at large, which is garnished on the inside with Fillets marked i i i.
 H. The great Pouch which is at the bottom of the Rectum.
 I. The Rectum.
 K. The Extremity of the Rectum, which forms a Swelling in the great Pouch.
 L. The Penis, its Origen is marked k: it is folded towards γ underneath, and suffers the part L to go through the Aperture of the little Pouch marked M M.
 N N. The Ureters.
 O O. The Opening of the Ureters into the great Pouch.
 P P. The two Muscles of the Anus and Penis.
 4 4. The two second Muscles of the Anus and Penis.
 3 3. The border of the hole of the great Pouch.
 Q. The Liver.
 R. The great Vena porta.
 S. The Origine of the Ductus Hepaticus.
 T. The upper Vena Cava.
 V. The little Vena Porta.
 X. The Aorta descendens.
 Y. The lower Vena Cava.
 Z Γ , Z Γ . The Kidneys.
 $\Gamma \Gamma$. The Ureters.
 $\alpha \alpha$. The Testicles.
 $\beta \beta$. The Crural Arteries.
 $\gamma \gamma$. The Crural Veins.
 $\gamma \gamma$. A part of the Colon in little, joyned to the double Cæcum formed like a Screw, marked $\delta \delta$.
 e e. The Passage or Matrix called Oviductus, in Birds.
 e. The internal Orifice of the Matrix.
 b. The Extremity of the Oviductus, which makes the Infundibulum or Tunnel.
 $\downarrow \downarrow$. The broad Ligament of the Matrix.
 λ . The Testicle of the Male.
 μ . The Vasa Spermatica Preparatoria.
 ν . The Epididymis.
 ξ . The Deferens.





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THE
ANATOMICAL DESCRIPTION
OF EIGHT
OSTRICHES.

THe Eight *Ostriches* which we describe, were almost of one size. There were five Males, and three Females; they were seven Foot and a half from the top of the head to the ground; from the Back to the Crown of the Head they were three foot; and as many from the Belly to the ground. The Body, from the Breast to the beginning of the Tail, exceeded not three Foot; the Tail was a Foot long; the Wing, without the Feathers, but a Foot and a half, being extended, and with the Feathers, three Foot.

The Plumage was also in some measure alike; for most of it had black and white, and some Gray Feathers. *Sediger* do's upon good Grounds laugh at *Cardan*, who was of Opinion, that *Ostriches* had red, blew, and green Feathers, not knowing that they are dyed of these Colours. The greatest Plumes proceeded from the extremities of the Wings and Tail. The great ones were most commonly white; and the next row was composed only of black. There were some of them smaller, being white, others black, which garnished the Back and Belly. The Flanks had no Feathers, no more than the Thighs, and under part of the Wings. The bottom of the Neck was half way adorned with Feathers, much smaller than those of the Belly and Back; some of which were black, and others white. They were gray in one of the Males, and in one of the Females.

All these Feathers were of one sort. This is peculiar to the *Ostrich*; for it has not Feathers of several sorts, like other Birds, which have some soft, and as it were lanuginous, to serve them for Furr; others hard and firm, for flying; some lanuginous only at their beginning, and firmer toward their extremity, which is made like a Scale, to the end that, being all ranged one upon the other, and covering some with their extremity, which is firmer, the Down which is at the root of the others, they might compose as it were a Vestment, to defend the Birds from the Inconveniencies of the Wind

and Water. Now this is not in the Feathers of *Ostriches*, which are all soft and fibrous like Down, so that they do serve them neither for flying, nor for covering them commodiously enough to defend them from external Injuries. We likewise observed another equality in the Feathers of the Wings of the *Ostrich*, which is peculiar to them: for the great Feathers of the Wings of other Birds, have one side broader than the other; but those of the *Ostrich* have the Stem exactly in the middle of the Feather. There is reason to think, that this equality is the ground of the Hieroglyphick of the *Egyptians*, who do represent Justice by an *Ostrich's* Feather.

In the enumeration of the Wonders of Nature which are read in the *Book of Job*, those of the Structure of the Wings of Birds is one of the most Considerable. This wonder is expressed by the reflection which God causes *Job* to make on the difference that there is between the Feathers of the *Ostrich*, and those of *Heron*s and *Falcons*; that is to say, of Birds that have Feathers for flying, and of those which have them not for that use; for there is nothing indeed more admirable, than this Structure of Feathers designed for flight, which consists principally in three things, *viz.* in the texture of the Threads and Fibres, of which the Beards of the feathers are composed; in the Figure of the whole feather, and in the particular motion of each feather.

To know and examine these particularities, it must be observed; that almost all sorts of feathers are composed of two parts, *viz.* of the Tube or Quill from whence the Stem proceeds, always lessening it self to the end of the feather; and of the Beards, which are fastned on each side to the Stem of the Quill, and which do make the breadth of the Feather: that the Threads whereof these Beards are composed, are flat, and plac'd with their flat sides towards each other, to the end that they might easily bend for the approaching each other, and that being harder to bend the other way, they do add more strength to the whole feather: that this strength and firmness is likewise fortified by the manner with which the threads whereof these Beards are composed, are interlaced with one another, this Texture or interlacing being made by the means of an infinite Number of Fibres, which the threads do shoot forth on each side, to hook and grapple with each other: that these Fibres are crooked after a different manner; for those which proceed from the Thread, on the side towards the extremity of the feather, are longer, more flexible, and bent down wards; and those which do proceed from the side towards the beginning of the feather or Quilly end, are shorter, firmer, and turned upwards. For it must be conceived that all these Fibres having Springs, those which are longest, most flexible, and bent downwards, do turn upwards at the meeting of the other Fibres, when two threads are forc'd one against the other; and that afterwards when these long Fibres are forced far enough over the others, their crooked parts falls into the Cavity made by the crooked parts of those other Fibres, even as the Latch that is fastned to a door, falls when the Door is thrust to and enters into the Cavity of the Catch fastned to the Door-post, and there hooking it self, fastens the Door: for it is properly after this manner that one thread of a feather is fastned to the other.

This admirable Structure of the feathers, which it is easie to see with the Microscope; succeeds so well for the uses to which Nature has designed it, that

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that when one thread has been separated from the other by some external Violence, it is capable of being reclasped with an incredible facility. It may be said that this is not unknown to the Birds; who frequently busie themselves in putting in order with their Beak the Threads of these Beards, when they have been disordered; for this is sufficient presently to recover and reduce into their former order those feathers which are so easily ruffled, and as it were broke; and this disposition is much more advantagious to them than if they were hard to ruffle or break, but being once torne or broken, were no more capable of revniting. And it may be said that this Structure has not been known by those who have thought that Birds do carry a kind of glue in their Beak, by the means of which they do again rejoyn their feathers when they are torne: for the Wings of Birds are neither mended with size nor glue; or at least they would be spoil'd, otherwise then they are, by the Rain and Waters, in which they are frequently Plunged, if their Fibres were joynded otherwise than by this admirable Texture, of which experience may easily be made, by separating the Threads of the Beards of the feathers, which are seen to rehook of themselves, and without glue, by reapproaching them only.

It must be observed in these second place that these threads are not perfectly strait, but a little bent, to make the whole feather hollow underneath; which serves for two things, *viz.* to make the Beards stronger and less capable of being bent upwards, when the feather suddenly strikes the Air; and to make the Air catch in this Cavity, more to resist the wing which beats it in its descent, and cause it also less to resist the same wing when it is raised, by reason of the convexitie of the feather over which the Air glides more easily than it would if it was flat: for it must be considered that for flight two things are necessary; the first that the Air greatly resists the Beating of the wing, to the end that the Bird may bear it self thereon; the second, that the same Air resist as little as is possible the raising up of the wing again; as well to the end that the Bird may not sink asmuch in raising the wing, as it rises in beating it down, as to lessen its force where the wing rises, least the Bird weary it self to no purpose.

In the third place it must be observed that for these very reasons, *viz.* of making the Air resist the wing striking it, and yield to it when it is raised, Nature makes use of two things: the first is that when the wing is raised, it becomes less than when it is beat downwards; which is done sometimes by closing the feathers, and makeing them to slip one under the other; so that the half of one covering the half of the other, each feather can strike the Air only with its half: Some times by making them to go from underneath the others, so that each strikes the Air with its whole breadth. The Birds which have the wings long and pointed, do make use of this means. The other way is for Birds that have shorter wings: for they do make use of an Artifice which Rowers do imitate in the management of their Oars, which is to make the Water to be struck with the flat of the Oar, when they do make it to go downwards, and that it be cut by the edge of the same Oar when they do raise it upwards: for the same thing happens to the feathers of the extremity of the wing, which do strike the Air with their flat, when the wing is lowered, and do cut it when it is raised; which is done by a

Motion like to that of the Oars which Watermen do make to turn a little, when they do raise them upwards: For each of the great feathers has this Motion apart, by which it is a little obliquely turned, when the wing is raised, and this feather is reduced into its former Situation when the wing is lowered. This Action is very distinctly observed when Birds do for some time, hold their wings erected, by an extension like to that which is done in reaching; this State affording more leisure to see that winding of the feathers, than when they do strike their wings in flight: for than the wings being thus raised, it is observed that the great feathers, which are the Principal Organs of flight, are all separated from each other, by reason of their obliquity, which seems to open, for the passage of the Air, as many Doors as there are feathers; which are closed when the wing coming to lower it selfe, all these feathers do retake their former Situation, and do beat one upon the other to make of the whole wing one continued surface, capable of overspreading a great quantity of Air.

In the fourth place, it must be observed that this oblique Motion of every feather belongs not to those of the Tail, which has different uses from those of the wings. There are two Principal ones; the first is to serve as a Rudder, and to keep in the whole Bird a strait Motion, when it is kept strait and of turning the body downwards, when it is kept lowered, or upward when it is raised. The other use is to serve to help it forward, when it is suddenly moved by these two successive Motions, which do produce the same effect as the Tail of Fishes.

Now this whole Mechanisme is wanting in the feathers and Wings of the *Ostrich*: For the threads of the Beards which are at the two sides of the stem of the Quill of the great feathers are never fastned one to the other, but floating and flexible, not being crooked, but strait and even without having any of the Dispositions necessary for the facilitating the interlacing which they have with each other in the feathers of other Birds. Therefore *Aristotle* says that the feathers of *Ostriches* are like the Haire of Terrestrial Animals, that is to say that they are more proper to cover their Body's than to fly with.

These Feathers have not likewise that particular motion which renders them some times strait, some times oblique, because that this would be useless to them, the Beards not being joyned together to make the Texture and Continuity which the other feathers have, to strike all the Air that is met with under the Wing; so that it may be said that the feathers of the Wings of the *Ostrich* are more like to the Pendants of Ships than to their Sails; altho' *Alian* reports that these Animals do make use thereof as of Sails, when to render their course swifter and lighter, they do extend these feathers to the wind, to the end that it may drive them: For sails are not only servicable in Ships merely as an Obstacle, which resisting the wind by its bigness only, receives a simple impulse so as the hull of the Vessel does; but they must be considered as an obstacle of a commodious figure and shape, which being managed and governed after a certain manner, may draw a greater advantage from the agitation of the Air, for the motion of the Vessel, than it would do without this figure and Government. Thus the Plumes of the *Ostrich* cannot be usefull to it by their figure or Motion, for if they assist them to advance forward by forcing their wings backwards, they would hinder them

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as much in bringing them forward, and there would happen to them one inconvenience to which the Wings of *Bats*, *Butter-flies*, and *Flyes*, would be subject, if Nature had not provided against it, by giving the Wings of these Animals the means of being contracted in such a manner, when they are raised, that they do strike a less quantity of Air, than when they are lower'd again. For this Contracting is made in *Bats* by the means of Bones that they have in their Wings, and which do make as it were the fingers of their hands, the distance between which are garnished with skins which they do contract and alternately extend as need requires. The Wings of *Butter-flies* and *Flyes* do perform the same Action by the means of certain Fibers, which have an effect like to that of the fingers of the *Bat*; and the speed and force with which the wings of *Flyes* are removed, and how they are capable of making so great a Noise as is that, not only of the buzzing of *Hornets*, but even of little *Flyes*, such as are *Gnats*, which is heard to a great distance, imitating the sound of a Trumpet, is a thing very Surprising.

The Motion of the Wings of the *Ostriches*, can at the most serve only after the same manner as that of the Tail of other Birds, and those of Fishes, which is in truth a motion proper to make a Progression; but it is certain that the Feathers of the *Ostrich* cannot have this effect, being like a tuft of loose and floating threads; seeing that to the end that such a Motion may have some effect, it is necessary that the Organ have a Surface, strait, even, and firm, such as it is in a Rudder, in an Oar, in the Sail of a Wind-mill, &c.

It is probable that the Author of the Book of *Job* had reflected on all these things, when he Describes the *Ostrich*, as an Animal to which God has deny'd the address which he hath given to other Birds, and which he has not furnished with Organs convenient to exercise the admirable Action of Flying; having scarce any other use of its Wings, than to raise them to receive the Impulse of the Wind, when it is favourable to its Course. Therefore *Cardan* compares, or rather very much opposes the *Ostrich* to the Bird of *Paradise*, which was formerly thought to have no Feet; because that the Bird of *Paradise* is a Bird, which according to the Opinion of *Cardan*, never walks nor lights on the ground, even as the *Ostrich* is one which neither Flies nor rises into the Air.

Besides the Feathers which we have described, we have observed that the top of the Neck and Head were garnished with a very fine, white, clear Down, shining like the Bristle of a Hog; so that it seemed to partake more of Hair than of Feathers. This Down was heaped together in little Tufts, composed of about twelve Hairs, of but one Line in length, except the Hair in the middle, which was four: All the Hairs of one lock had all together but one Root, which was a little Tube about the bigness of the smallest Pin. This Downe was very clear and very thin in the Neck, and much more on the Head, which was absolutely bald at the top: This *Pliny* reports to be Natural only to two Birds, *viz.* the *Ostrich* and *Cormorant*, for that reason called *Phalacrocorax*.

At the end of each Wing there was a kind of Spurr, made almost like the Pricks of a *Porcupine*: They were an Inch long, and a Line and a half thick at the *Basis*; their Substance was Horny; they were hollow, and in the Cavity there was a Cartilage covered with Membranes and Ligaments, with

a great quantity of Vessels full of Blood. *Aldrovandus* confesses that he could never find these Pricks in the *Ostrich*: *Albertus* reports that they do serve them for offensive Arms: *Johnston* is of opinion that they make use thereof as of a Spurr, with which they excite themselves to speed. There were two on each Wing, the greatest was at the extremity of the last Bone of the Wing, the other was half a Foot lower.

The Neck seemed more slender in proportion than it appears in other Birds, because that it was not decked with Feathers, as was said. The Skin of this Neck was of a livid flesh Colour; *Gillius* makes it blew. The Head did likewise appear very small, for the same reason of the want of Feathers. *Albertus* finds it absolutely small. *Scaliger* has reason to reprehend *Cardan*, for averring that Birds have commonly the Head little, to the end that its weight may not hinder them from flying; because there are a great many which fly little, as *Hens*, which have the Head much less in proportion than other Birds which do easily fly: But it is probable that *Cardan* found that his Theoreme was confirmed by the example of the *Ostrich*, which flies not, and whose Head without Feathers is absolutely greater in proportion to its Body, than it is in other Birds.

The Beak was short and pointed: It measured two Inches and a half broad at its beginning; its Figure like that of the rest of the Head, did not in any sort approach the Figure which the Head and Beak of a *Goose* generally have, as those have ill thought who have called the *Ostrich* *Chenocamelus*, that is to say *Goose-Cammel*.

The exterior form of the Eye did sufficiently resemble that of Man, and was very different from the ordinary form of Birds Eyes, which have the Aperture of the Eye round, and the upper Eye-lid unmovable, and without hair; and the line which goes from one Corner to the other, always oblique: For our *Ostriches* had the Aperture of the Eye oval, a great Eye-lid at the top, which lower'd it selfe as that below was raised, having great Eye-lashes, which, as in man was a great deal longer than those of the Inferiour Eye-lid; in the line which went from one Corner to the other being strait, according to the direction of the Beak, there was a third Eye-lid on the inside, as in the generality of Brutes: 'Twas a very thin Membrane, which was hid in the great Corner towards the Beak. *Aldrovandus* thinks Birds have this Eye-lid, to supply the defect of the upper Eye-lid, which is so short that it cannot lower it selfe to cover the Eye as it does in Man. But it is probable that this internal Eye-lid has another use in Birds, seeing that it is found in the *Ostrich*, whose upper Eye-lid is large enough to be able easily to lower it selfe; add moreover that the inferiour Eye-lid shuts up in Bird's against the superiour, as exactly as the upper is joyned in man with the lower.

The Tongue was small, adherent as in *Fishes*, composed of Cartilages, Ligaments and Membranes intermixt with fleshy Fibres. It was different in our Subjects: In some it was an inch long, very thick at the Aperture of the *Larynx*; in others it was not half an inch long, but it was above an inch towards the basis, being a little forked at the end. Beyond the slit of the *Palate*, towards the *Pharynx*, there were two great Glands, which furnished the Spittle.

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The *Thighs* were very fleshy, and very big, and without Feathers, covered with a white skin somewhat reddish, raved by elevated wrinckles, of the Figure of a Net, whose Masses could receive the end of ones finger. In one of the Males, there were little Feathers here and there upon the *Thighs*, almost after the same manner as *Gesner* has described it in his Figure. Some had neither little Feathers nor Wrinckles. The *Legs* were covered on the fore-part with great square Scales.

The *Foot* was cleft, and composed only of two very large *Toes*, which were covered with Scales like the *Leg*. These *Toes* were unequal: the greatest, which was on the inside, measured seven inches, comprehending the *Claw*, which was nine lines in length, and a little less in breadth; in some resembling the Naile of a Mans great-Toe. The other *Toe* exceeded not four inches, and had no Naile. This little one touched the ground only at the end. The great one being seen sideways had almost the shape a Mans Foot, with its shoe on: it was only a little thinner and longer. *Pliny* reports that the Feet of the *Ostrich* are like to those of the *Stag*. *Diodorus Siculus*, who calls the *Ostriches* *Stagg-Birds*, relies upon this false resemblance. *Suidas* is likewise more mistaken, when he says that the Feet of the *Ostrich* do resemble those of an *Ass*. Those who have named the *Ostrich* *Serutho-camelus*, that is to say, *Cock-Camel*, according to *Scaliger*, and according to the *Chaldee* Paraphrase of the fore-cited place of *Job*, have not erred so much: for the length of the *Legs* of the *Ostrich* has some similitude with those of the *Cock* and *Camel*. Moreover the manner after which the *Foot* of the *Camel* is cleft, which is different from all other cloven Feet, and its *Claw*, which is also quite of another Nature than that of *Staggs* and *Goats*, are particularities which are common to it with the *Ostrich*. Our *Ostriches*, like the *Camel*, had a Callosity at the bottom of the *Sternum*, on which they do rest like the *Camel*, when they lie down.

Near the *Anus*, in one of the five Males, there was on each side three holes of a line and half diameter, and two lines in depth.

At the top of the *Thorax*, under the skin, there was Fat about the thickness of two fingers. There was some more especially on the fore-part of the *Belly*, which was hard like Suet: it was in some places two inches and a half thick. This Fat was inclosed between two Membranes as strong as the *Peritonæum*. These Membranes, which thus inclosed this Fat, were the *Aponewroses* of the Muscles of the lower *Venter*, which began to be fleshy only towards the Flanks, the whole fore-part of the *Belly* about the breadth of a foot being without flesh. The *Sternum* descended not to the bottom of the *Belly*, because that the Muscles which move the Wings, and which are fastned to the *Sternum*, have no need of being so great as in other Birds which fly.

The *Oesophagus* was seated on the Body of the *Vertebra*, being fastened to the *Aponewroses* of the Muscles of the *Lungs*; of which more shall be spoken in the sequell. Its *Tunnels* were very thick, especially that which is fleshy. It was insensibly enlarged, even to six inches in breadth near the *Ventricle* or *Gizzard*; so that it was difficult to mark the place of the superiour Orifice of the *Ventricle*: it seemed that the extremity of the *Oesophagus* did form a *Craip* which was confounded with a *Gizzard*, and that these two parts together

ther did compose one single *Ventricle*. This Conformation, (which, in general, is very different from that which is common to Birds, where the *Crow* is us'd to have a Contraction which separates it from the *Gizzard*,) was likewise more strang, by reason of the Situation that it had: for it was not only in the Stomach, but it was lower than the *Gizzard*, underneath which it descended, and towards which it afterwards re-ascended, so that the entrance of the *Gizzard* was through its bottom; and thus the Orifice, which is commonly called the superiour, was indeed the inferiour.

In some of our Subjects, the *Gizzard* was separated on the inside into two Cavities by an Eminence formed by its Musculous Flesh, which, towards the middle, was above two inches thicker than any where else. This Eminence contracted the internal capacity directly over the middle, and separated it on the left side, where was the inferiour Orifice, called *Pylorus*. The Figure of these two Cavities did not outwardly appear, the flesh of the *Gizzard* being equal; and the whole together had the Figure of the *Ventricle* of Man, making an oval, which was fifteen inches in length and eight in breadth. *Alian* seems to give several *Ventricles* to the *Ostrich*, as to Animals which chew the Cud, when he says that this Bird digests Stones in the *Ventricle* called *Echinos*, which is the second *Ventricle* of ruminating Animals, which is so called, by reason that its interior Membrane is filled with wrinkles armed with points like the *Hedge-hog*, which the *Greeks* do call *Echinos*: but this sort of *Ventricle* was not found in our Subjects. It may only be said that the *Ventricle* of some of the *Ostriches* that we dissected is double, and not that they have two *Ventricles*; seeing that both the parts of the double *Ventricle* are covered with the same Membrane, and that this Membrane is different in the different *Ventricles* of Animals which chew the Cud. For the Membranes of the *Crow* were garnished with Glands regularly ranged, and framed like the ends of small Pipes, being round, and pierced through the middle at the part towards the inside of the *Crow*, and unequal on the other side, being composed of several *Gruines*, after the manner of conglomerated *Glands*. And in this they differed from the *Glands* which are found in the *Crows* of the *Demofelles* of *Numidia*, *Geese*, *Ducks* and several other Fowl, where these *Glands* are seen pierced only as in the *Ostrich*, but they are single, and of the kind of those called Conglobated.

The Membrane that coated the inside of the *Gizzard*, and which was easily separable therefrom, was a line and half in thickness in some of our Subjects: It was composed of two parts, viz. of a *Tunicle* which was immediately fastened to the Flesh of the *Gizzard*, and of a heap of little Glandulous Bodies, which made a kind of Velve. These small Bodies, in most of the Subjects, were so minute, that they appeared to be rather Fibres than Glands: in some they were about the bigness of a great Pin, and above the length of a Line. They were joyned and glued to each other, as the Fibres are in Wood. There was a great many places where these small Bodies were separated, and made several clefts or chinks. The *Ventricle* of the *Cormorant* was almost of this Structure.

These *Ventricles* were always found full of Hay, Grass, Barley, Beans, Bones, and Stones, of which there were some as big as a Pullers Egg. There were likewise some *Doubles*: in one we counted severny of them. They were

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most of them worn and consumed about three quarters, being scratch'd by their mutual rubbing, and by that of the Stones, and not by Corrosion caused by any humour or acide Spirit, as we found ; because that some of these *Doubles*, which were hollow on one side, and bossed on the other, were so worn and bright on the side of the Boss, that there remained nothing of the Figure of Money : whereas the side which was hollow, was not at all damaged, its cavity having defended it from the rubbing of the other *Doubles*. All the rest which was contained in the *Ventricle* with these *Doubles*, as well Stones, and Bones, as Pulse and Hay, was green. Wee found the same thing in the *Ventricle* of a *Bustard*, where there were Ninety *Doubles* worn by this rubbing : they had likewise given a green Colour to a great deal of Hay which was there.

This made us to think that in Birds, and generally in all Animals, the dissolution of the Nourishment is not performed only by subtille and penetrating Spirits, but also by the Organical and Mechanical Action of the *Ventricle*, which compresses and incessantly beats the things which it contains ; so that in the generality of Animals which do swallow a hard Nourishment without chewing it, (as Birds which live on Grain,) Nature has made their *Ventricle* Musculous, and has given them the instinct of swallowing Stones, by the means of which they may break in their *Ventricle* what others do bruise with their Teeth. In fine this Affectation which the generality of Birds have of swallowing Stones, has a more manifest use than that which *Eagles* and *Cranes* have of putting Stones into their Nests. *Cardan*, and the generality of other Naturalists, are of Opinion that the *Ventricle* of Birds, and especially of the *Ostrich*, is fleshy, to afford it more Heat : but it is known that the Musculous and Fibrous flesh acts more by its Motion than by its Temper ; and that one of the principal and most important Actions of the Heart, is that of Contraction and Dilatation, which serves not less to the Concoction and alteration of the Blood, than to its distribution. It is probable that those who have thought, that the Stones and Iron which *Ostriches* do devour, are dissolved in their *Ventricle* by a particular virtue that Nature has given to the *Ventricles* of different Animals ; by which some do digest Poysons, others Bones and raw Flesh ; and that the *Ostrich* was furnished with that of digesting Metals and Stones, reflected not on that attraction of the Peices of Copper which we have observed, and much less on the verdure, with which all that was contain'd in the *Ventricle* was tinged. For if the *Ventricle* of the *Ostrich* had a faculty peculiar for digesting of Metals, it would digest them after the same manner as other things are digested ; which is to be melted and dissolved, without suffering other change in their Colour, than to become white ; which proceeds from the almost infinite little bubbles which the boyling of the Fermentation there produceth : For this Ebullition gives a white Colour to whatever it Agitates, as is seen in the Froth of Inck, which is white. It is likewise known by Experience that the things which are dissolved in the *Ventricle* do receive an alteration in their Substance, without changing Colour ; as it is remark'd in *Craw-Fish*, which are found half digested, in the *Ventricles* of Fishes, with their Natural blackness, and not having that redness which they do acquire, when the Heat of the Fire Boils and alters them, after a manner, which is very different

from the hear of Animals: So that the greeness which happens to Copper in the *Ventricle* of the *Ostrich*, cannot proceed from a Dissolvent, that it has to Digest Metals; but there is a probability, that the Dissolution is there made, after the same manner as it should have been done out of this *Ventricle*, if the Copper had been champed with Herbes, or some acid or saline Liquor, of what Nature soever it were, and which should be very different from this acid or salt; or else from that general Dissolvent (whatever it be,) of all that is capable of affording Nourishment: So that it is credible that the *Ostrich* being a Voracious Animal, which has need of Swallowing some hard thing, that is requisite, as has been said, to break its Nourishment; it misuses the instinct which Nature has given it for that end, when it Swallows Iron, and especially Copper, which is turned into Poison in its Stomach, instead of turning into Nourishment. And indeed, we were informed by those who look after these Animals in the Aviary of *Verisalles*, that the *Ostriches* which do Swallow much Iron, or Copper, do all Dye presently after.

The *Intestines* in our Subjects were different in length, altho' the Animals were almost of the same size. In one they were fifty Foot, in another forty two, in a third thirty three, in a fourth twenty nine. The three smaller *Intestines*, had scarce more length than the *Colon* and *Rectum* together. The *Cecum* was doubled, as in most other Birds; each comprehending two Foot in length, more or less, in proportion to the length of the other *Intestines*.

The External Surface of the *Colon* and *Cecum* were uneven, with some very regular Bosses, but different in each of these *Intestines*. These Bosses were formed by some leaf-like Ligaments, which were on the inside, almost the same as they are seen in the third and fourth *Ventricle* of Animals which chew the Cud. In the *Colon* these leaves were transversely situated, each making more than half a Circle, and being alternately placed; so that the ends of two Semicircles, did receive and include the extremity of another Semicircle, as if one did put the Teeth of two Combes within one another. These Semi-circles were half an Inch distant from each other, and were but three Lines broad in their middle, and went lessning to nothing. All along this *Intestine*, in the Posterious Part, there was a Ligament two Lines broad, which being in length a third less than the *Intestine*, did contract it, and make the Interior and Semi-circular Ligaments to Form the Folds and Bosses, which appeared still more observable, when the *Intestine* being blow'n up, the whole Membrane, which was not retained and held by the Ligaments, was extended by the impulsion of the Air. All the Vessels entered at the side of this Ligament, to distribute themselves into the *Intestine*, but particularly into the Leaves. This Structure of Leaves transversely seated in the *Colon* hath already been observed in the *Ape*, where mention is made of the discovery that we have made, of such Leaves in the *Jejunum* of Man; but we deferred to give the Figure thereof till we came to the *Ostrich*.

The *Cecum* was likewise furnished with Leaves on the inside, or rather with one single Leaf, which turned like a Screw from one end to the other, almost after the manner described in the *Sea-Fox*, and as it is in *Hares*, and *Rabbits*. This Leaf was of the same breadth, viz, five Lines every where:

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It went only somewhat contracting towards the extremity of the *Intestine*, proportionally as the *Intestine* is lessened, which went pointing, as in most *Quadrupeds*, and contrary to the Nature of Birds, where this *Intestine* keeps the same breadth throughout its whole length, and which sometimes increases itself, as we have observ'd in the *Pinsado*, where this enlargement is more considerable, than in any other Bird that we have seen.

At the extremity of the *Rectum* there was a great Bladder fill'd with Urine, to the quantity of eight Ounces: It might contain ones two Fists, The Membranes which compos'd it, were like to those of the *Intestines*; but they were a little thicker. In one of our Subjects, which was a Female, this Bladder was disseminated on the inside with a great number of Vessels, which came as it were from a Center, and spread over its whole capacity: These Vessels were not visible in the other Subjects. Directly over this Center, was the hole through which the *Rectum* emptied it self into the Bladder 'Twas a very straight hole, in the middle of a Tumour of about the bigness of a Nutt, which made as it were a *Hen's Arse*. At the bottom of this great Bladder there were likewise two holes, which were the Mouths of the *Ureters*, which did run betwixt the two *Tunicles* of the Bladder, like to that of *Terrestrial Animals*. Underneath these two holes was an oval Aperture ten Lines in length, which had a Membranous border, by the means of which it might be closed, when it came to be compress'd by the weight of the Urine: For then this Membranous border joyn'd it self to a swelling or round Body, being of about the bigness of ones Fist, of a middle Substance between a Cartilage and a Ligament. This *Tuberositie* was cleft in the middle after the manner of an *Apricock*, being fastened on the inside to the *Os Pubis*.

This Oval Aperture gave passage into a second Bladder or Pouch, lesser than the first, and which was not made to containe the Excrements, but only to give them passage, according as its *Tunicle* did more or less compress, and close the *Tuberositie* which did fill it, by an Action like to that of the Membranous border of the Oval Aperture.

The *Penis* in most of our Subjects was compos'd of two Substances, viz. of white, thick, Nervous, solid Membranes, and of white Ligaments, of the same Substance as the Membranes, but a great deal harder and more solid, having neither in the Membranes nor in the Ligaments any Vessels, nor Cavity: They appear'd compos'd only of transverse *Fibres* very compact. The external Membrane which covered the whole *Penis* was the thickest: The internal did immediately envelope each of the two Ligaments, which were separated from each other, and were united about two Fingers from the extremity. There was one longer than the rest; the longest was two Inches: They were each four Lines Diameter towards their *Basis*, going pointwise towards the extremity. The Origine of this *Penis* was at the Cartilaginous swelling which was fastened to the internal part of the joyning of the *Os Pubis*, of which it is just before spoken; from thence it was reflected turning short downward, entred into the little Pouch, and came out at the external orifice of this little Pouch, which is the *Anus*. This Aperture was bordered with a Semicircular fold, which embraced the *Penis*, at the place where it went out. In short this *Penis* had neither Gland,

Prepuce, Ductus, nor *Cavity*, which might give passage to any Seminal Matter. In one of the Subjects, besides the Membranes and Ligaments which composed the *Penis*, there was also a third Substance, red, Spongi-ous, and much resembling that of the Cavernous Ligaments of *Terrestrial Animals*. It was garnished with a great quantity of Vessels.

In the Female, instead of the *Penis*, there was only the Cartilaginous Swelling, which filled the second Pouch as in the Male; and this Tumour came out of the *Anus* about the bigness of a small Nutt: It had a little Appendix about three Lines long, thin, and bent back. It is likely that this is the *Clitoris*.

In this little and second Pouch, there was on the left side a hole into another Cavity, in manner of a Passage, which was the *Oviductus*. This Hole exceeded not four Lines in Diameter. It had wrinkles all round; after the manner of the external Orifice of the Females of *Quadruped's*. In one of our Subjects the Tunicle of this *Ductus* were very thick, and its Cavity very large near the entrance: In another it was less; and about five Inches beyond the entrance, it was contracted to Form another Passage five Lines long, hard and Nervous, which might pass for the internal Orifice of the Matrix. Underneath this Strait Passage, there was a little Bag or Pouch, not perforate, the depth of which was equal to the length of the Passage. In the Subjects where this Strait Passage was not found, the *Oviductus* contracted it self, from its first entrance till as it approached the *Ovarium*; so that at its extremity it exceeded not four Lines in breadth, instead of three Inches and a half, which it had at its middle. In this extremity it formed that Hole which is called the *Infundibulum* or Tunnel of the *Oviductus*, and sent forth, on the right and left side, two Membranous Appendices, which had some similitude with those that are at the extremity of the *Tuba* of *Terrestrial Animals*.

This whole Passage, which is properly the *Matrix* or *Cornua Uteri* of Birds, was two Foot and a half long, and capable of receiving ones Fift in its largest part. It was fleshy at the beginning, and became insensibly Membranous towards its end. After having ascended, by turning on the left side towards the *Ventricle* it was reflected towards the Back-bone, descending. A double Membrane, in form of a large Ligament, fastened it: It had an Edge the length of two Inches on each side: The hinder part of this Ligament was fastened along the Back-Bone, like a Mesentery: the Anterior was loose. Both were intermixt with a great number of Vessels, which were in greater quantity on the Passage of the *Oviductus* than in the Ligament. These Vessels did come from two great Branches which entered through the extremity of the *Oviductus*, towards the *Ovarium*: the one went along the top, the other the bottom; and their Branches had some *Anastomoses* with each other, viz. those of the lower part with those of the upper.

The whole Passage of the *Oviductus* was composed of three Membranes. except the extremity, which makes the *Infundibulum*, which seem'd to be of a single Membrane. The Interior of these Membranes was mightily wrinkled, or rather as it were leaved, after the manner of the third and fourth *Ventricle* of Animals that chew the Cud. These Leaves, which filled

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all the Cavity, went lengthwise, and a very thin Tunicle joyned them together. The second Membrane, which was that of the middle, was fleshy. The third, which was thin and sleek, was nothing but the double Membrane, of which the broad Ligament was composed, which was divided in two to embrace the Passage of the *Oviductus*.

We observed four Muscles, appertaining to the *Anus* and *Penis*: There were two on each side. The two first took their Origine from the internal part of the *Os Sacrum*, and descended along the Pouch of the *Rectum*, for the space of two Lines: they pierced it near its extremity, and passing under the *Sphincter* of the *Anus*, inserted themselves at the *Basis* of the *Penis* in the Males, and at that of the *Clitoris* in the Females. The two others went from the internal part of the *Os Ilium*, towards the bottom of the Kidney's, and descended at the sides of the *Ureters*, and also piercing the *Rectum*, fastened themselves to the sides of the *Penis* and *Clitoris*.

The *Ovarium* was placed at the upper part of the Kidney's against the *Vena Cava* and *Aorta*, being strongly fastned to the Trunks of these Vessels, and garnished with several Eggs, covered with their skins as in Hens. These Eggs were of a different size, *viz.* from the bigness of a Pea to that of a Nutt. The Membrane, which included each Egg, and which in *French* is called *le Calice*, had as it were a Tail, by which these Eggs are commonly connected alltogether, and do compose that which is called the *Ovarium*. This Membrane was the thicker the lesser the Eggs were. It had a great quantity of Vessels, and was fastened to the Egg which it inclosed, by an infinity of Fibres, being open towards the place opposite to the Tail, as is the Cup of an Acorne, when the Acorne is round and small, and when it is almost all covered with its Cup. The Egg being separated from the *Calice* or Cup, was only a very delicate Coat, which contained only the Yolk of the Egg, in those which were not bigger than a Nutt; but in one of our Subjects where it was found about the bigness of two Fists, this Coat was filled with a humour like unto muddy Water, excepting that it was yellow. There is ground to believe that the Natural Heat weakened in this Animal, by the contrariety of the Air of our Climate, had corrupted these Eggs.

One of the *Ostriches* which are in the Park of *Versailles*, having lay'd several Eggs, some were brought to us, on which there was made some Observations and Experiments. For as these Birds do not sit on their Eggs, but expose them to the Ray's of the Sun and the Heat of the Sand, contenting themselves with securing them from the Rain, by laying them on little hillocks of Sand; we resolv'd to try whether by the Heat, as well of the Sun, as of the Fire, and Dung, we might at least procure in them any Alteration, that might seem a Disposition to Generation. For this end there was one kept five weeks in the Sun, half buried in Sand, on a Bed of Dung raised three Foot from the Ground, covering it with a Glass Bell during the ill weather. Another was put into an *Athanor* with a gentle Fire, keeping it also, for the like space of time, in Sand and well covered. We observed several things, *viz.* That the Eggs diminished a ninth part of their weight; That the yolk and white of that which had been heated in the Fire, were somewhat thickened, without having any ill Scent: That which had been lay'd

lay'd in the Sun was not thickened, but had contracted a very ill Smell: And that in neither the one nor the other of these Eggs, there was found any appearance of Disposition to Generation.

At the top of the *Ovarium* there was discovered two Glandulous Bodies fastened to the *Aorta*, and *Vena Cava*, whose Substance was like to that of the Testicles of the Males, having in their Superficies a great number of Vessels. Their Colour was of a brisk red. Each of these Bodies measured an Inch and half in length, and four Lines in Diameter.

In the Males the *Testicles* were of a different Size and Figure in the different Subjects. In one they were small, being only fifteen Lines in length and five in Diameter. In another they were long and narrow, being an Inch and half long and four Lines only in Diameter. In a third they were four Inches long, and an Inch and half Diameter through the middle. These last had the Figure of a *Puller's* Egg a little extended, being larger at one end than the other. In all the Subjects they were covered with a Nervous Membrane, Sprinkled with so great a quantity of Vessels, that it appeared red. In one of the Subjects we found the *Testicle* had as it were another little one, fastened to its side. This little one was about a fourth of the great one, and was nothing else but the *Epididymis* separated from the *Testicle*, which was joyned to it in two places; viz. by a Branch of the *Vas Spermaticum Præparans*, which proceeding from the middle of the *Testicle*, did enter into the middle of the *Epididymis*; and by the *Deferens*, which proceeding from the bottom of the *Epididymis*, was rejoyned to the bottom of the *Testicle*.

The *Vasa Præparantia* came out near the *Emulgentes*, and were joyned a little lower to the *Testicles*, which were laied on the Kidneys, a little more on the left than on the right side: Before their connecting to the *Testicle*, they were each divided into three Branches, which joyned to each other, and afterwards separating, did thus continue to communicate themselves along the *Testicle*, to which they inserted some Branches at equal Spaces. In this place they were exceedingly envelop'd with Membranes and Fat: But notwithstanding these Impediments, their Structure and Communications were distinctly seen; because that having boiled one *Testicle*, and all the Fat being melted, the Vessels evidently appeared, and shewed that after being united, they were separated, to rejoin again. The *Deferens* descending along the *Spine* to the second Bladder, was there fastened, after being dilated, and changed into a Membrane. This *Ductus*, as usually, was solid, and without Cavity at its beginning, and at the end it was enlarged, and became Membranous.

The *Liver* was red, of a Substance hard and firm. By its Figure it resembled that of a Man, being divided into two great Lobes. The left was parted into two other small ones. There was also another little one, in the middle and at the bottom of the two great ones, which was found but in one of the Subjects. There was no Gall-Bladder, but only a *Ductus Hepaticus*, which proceeded from the middle of the hollow part of the Liver, and inserted it self at the *Pylorus*. The *Ductus* was formed by the uniting of three great branches, which were distributed into the whole Substance of the Liver. At the extremity of one of these Branches, very near its Insertion

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on into the *Ductus*, there was a Dilatation about the bigness of a great Fil-beard, which did not appear because it was again covered over by the *Parenchyma* of the Liver.

The *Vena Porta* was double, having two separate Trunks, and each their particular roots. The first, which was the bigger, was fastened to the right Lobe, at the place where the *Gall-Bladder* commonly is in Birds. The second (the lesser) came out from the bottom of the left Lobe. The *Vena Cava* was joyned along the great *Diaphragme*, right by the side of the *Aorta*.

The *Pancreas* was ten inches long, and an inch broad. It was placed between the first fold, which the *Intestines* do make in forme of a long Sinuosity as in most other Birds. It was of a true flesh-Colour. The Glands whereof it was composed were wholly separated from each other, and joyned only by Membranes. The *Ductus Pancreaticus* was knitt to the upper part of the *Jejunum*. It proceeded from the middle of the *Pancreas*, where the two branches joyned, which it shot forth into each half of the *Pancreas*, one towards the top and the other towards the bottom. It is remarkable that in the Generalitie of Birds, the *Ductus Pancreatici* are inserted near the *Cholodochi*; but in our *Ostriches* the insertion of the *Pancreaticus* was above three foot distant from that of the *Hepaticus*.

The *Spleen* was fastned to the Ventricle by a strong Membrane, which conducted and held the *Spleatick Vessels*. It was Cylindrical, being two inches and a half long, and Eight Lines Diameter; yet it was a little smaller at the bottom than at the top. Its *Parenchyma* was Solid, and like to that of the Kidneys of *Quadrupeds*.

The *Kidneys* comprehended eight inches in length, and two in breadth. In most of our Subjects they were different from the Kidneys of other Birds, not being cut into several Lobes, but having a continuity very equal. Their whole Substance, which was quaggy, appear'd moreover very unequal, as being composed of a great quantity of Glands. They had a very fine Membrane, that immediatly covered them, which was again covered over with another stronger and thicker, supplying the use of the *Membrana Adiposa*. The colour of these Glands was of a very brisk dark Red. In some of our Subjects we found the Kidneys were cut in three as usually, the upper and lower part being larger than that of the middle. The *Ureter* was not, as in other Birds, lay'd upon the Kidneys from top to bottom, but it was included in their Substance, where it was a little larger than outwardly, as it were to form a *Pelvis*, which was about the length of the Kidney. In this *Pelvis* there was seen several holes, which were the Mouths of the Branches or Channels which the *Pelvis* sends into the whole Substance of the Kidney. There was not any appearance of *Papilla*.

The *Rings* which composed the *Aspera Arteria*, were intire, but a little compressed, which gave them an Oval Figure. The *Larynx* consisted of one *Cricoides*, and one *Arytanoides*. The *Cricoides* resembled that of a Man, and the *Arytanoides* was made of two flat and large Cartilages, articulated with the *Cricoides* by the means of their Muscles. Between them they left an Aperture of six Lines, which made the *Glottis*. These two Cartilages were covered over with one Muscle, which plainly serv'd to close the Mouth of the *Glottis*, by drawing them together.

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The *Diaphragme* was not single, as in terrestrial Animals, where there is but one Partition, which separates the Parts contained in the *Thorax* from those of the lower *Venter*: But there were several *Diaphragmes*, which made a great many separations, by dividing the Cavity of all this part of the Body, which is called the Trunk, into six other Cavities, by the means of five Partitions, which may be taken for as many *Diaphragmes*.

There were four of these *Diaphragmes* or Partitions, whose Situation was direct from top to bottom, and a fifth seated a Cross. Of the four strait ones, two were little, and two great; the little ones covered the Lungs, which were fastened to the sides, and separated them from the four upper Bladders of the Lungs. The great *Diaphragmes* which covered these Bladders, as the little Ones covered the Lungs, left a great space in the middle where the Heart and Liver were included together. The fifth *Diaphragme*, which was seated cross-wise, going from the middle of one of the great *Diaphragmes* to the middle of the other, separated the Heart and Liver from the Gizzard, the Intestines and other parts of the lower Belly, in which the two inferior Bladders of the Lungs were likewise held. So that the six Cavities were, a great one of the lower *Venter*; another great one of the middle of the *Thorax*, seated over the first; two middling ones at the side of the second, which contained the four upper Bladders; and two little ones at the side of these middling ones, where the right and left Lungs were inclosed.

Each of the little *Diaphragmes*, (which we call the *Muscle* of the Lungs, because that it was fleshy, and covered the Lungs,) had its Origine very fleshy, which was divided into six heads fastened towards the extremity of the great Ribbs, near the Angle which they do make with other little Ribbs that fasten them to the *Sternum*, instead of the Cartilages which knitt them in Terrestrial Animals. These six Heads did altogether produce a large Tendon or *Aponeurosis*, which being couch'd on the Lungs, went to joyn it self with the *Aponeurosis* of the other opposite Muscle, on the *Vertebra* of the Back, to which it was also strongly connected. The direction of the Fibres of this Muscle was Oblique, inclining a little towards the bottom, so that its Action is to contract the *Thorax* by closing the Ribbs, and drawing them downwards.

Each of the great *Diaphragmes*, which was only a Membrane without Musculous flesh, and consequently without Action, and serving only for a partition, has seem'd to us to merit rather the name of *Diaphragme*, than the two little ones that were Musculous, and also than the *Diaphragme* of Terrestrial Animals, which serves for other purposes than to separate the upper Belly from the lower; being principally employed by its Motion in the Respiration which is called free, as are the Muscles of the *Thorax* for the Respiration which is called Violent and forced, the which is performed by the Dilatation and Constriction of the *Thorax*. Each of these *Diaphragmes* was joyned at the top, and at the fore-side, along each Ribb of the *Sternum*, which was very broad in our *Ostriches*, as it commonly is in Birds. At its back-part it joyned to the *Aponeurosis* of the Muscle of the Lungs, and by the means of this *Aponeurosis* to the *Vertebra* of the Back: At the bottom it was fastened to the transverse Muscle of the lower *Venter*.

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the *Sternum*. It proceeded from the middle of one of the great *Diaphragmes* and cleaving on the forepart to the Transverse Muscles of the lower Belly and on the hind-part to the *Aponeuroses* of the Muscles of the Lungs, it went to fasten it self to the other great *Diaphragme*. Underneath it was garnished with Fat about the thickness of ones Finger.

The Lungs, being included between the Ribbs and little *Diaphragmes*, called by us the Muscles of the Lungs, were composed of two Red and Spongi-ous fleshy parts, as in other Birds. They were each ten inches long and three and a half broad, being an inch and a half thick. Each of the two Branches of the *Aspera Arteria*, entering into the Lungs, was divided into several branches, which were distributed into its whole *Parenchyma*, as in Terrestrial Animals, except that all these Branches were simply Membranous without any Cartilages. The Air passing into these branches, went to the external surface of the *Parenchyma* which was pierced with an infinite number of little holes, which were seen through a very thin Coat, wherewith the whole Lungs were covered to inclose the Air, and let it out only thro five holes, each about five lines Diameter, and ranked according to the length of the Lungs, some towards the Back-bone, others towards the *Sternum*. Those holes which were towards the *Sternum*, piercing the fleshy part of the Muscle of the Lungs to penetrate into the Bladders, were oblique; and it seem'd to be thus formed that the Air might be voluntarily retained in these Bladders by the Action of the Muscle, which, by contracting it selfe, might lessen this hole, for some uses which may be conjectured, as it shall be explained in the sequel.

The four Bladders which were on each side at the top of the *Thorax*, were included, as has been said, between the *Diaphragme* and the Muscle of the Lungs wherewith they were covered over. The Coat of each Bladder was fastened by the sides of the *Diaphragme* and Muscle of the Lungs. At the top and bottom it was joyned to the Coats of the Neighbouring Bladders between which it was. The fifth Bladder, which was a great deal larger than the rest, was not included between the *Diaphragme* and the Muscle of the Lungs, but between the two *Diaphragmes* with the *Intestines* and other parts of the lower Belly; and that they toucht the Muscle of the Lungs only at the place where it was Pierced, to give passage to the Air that it received from the Lungs. In *Eagles* and some other Birds, we found these Bladders fastned by the bottom to a Membrane exceedingly loaded with Fat, which inclosed as in a Sack the *Ventricle* and *Intestines*, and which we have taken for an *Epiplon*.

The parts of this Structure could not be so well observed in other Birds, by reason of the tenderness of the Coats whereof these Bladders are composed, which in the *Ostrich* are about the thickness of a Hog's Bladder; and we found those of the lower Belly in one of our Subjects four times thicker, being Scirrhus: But in most other Birds it is almost impossible not to cut them in making the Dissection, and they can be well viewed only, by keeping them extended by blowing into the *Aspera Arteria*. This knowledge of this Structure gave the Society an occasion of making several Reflections on the manner of Respiration in general, and on that particular to Birds,

to endeavour to arrive at the knowledge of the uses which these Organs must have, which are so different in the one and the other of these Animals.

It was considered that Respiration serves not only to the refreshment of the Heart, and to the Voice, but that it is also useful for the Concoction and Distribution of the Nourishment, by the continual agitation and constriction of the *Thorax*, which pressing the Lungs fill'd with Air, and by this Means rendered like soft Pillows, makes that they gently squeeze out; not only the Blood contained in their Vessels, and push it into the Heart; but do also compress the other Vessels shut up in the *Thorax*, to favour the distribution of the blood, as it appears in violent Actions, where the retention of Respiration is necessary; for it is observed that it makes the blood to rise up into the Face. But the manner whereby Respiration is accomplish'd by Inspiration and Expiration, does evidently demonstrate the verity of this use in terrestrial Animals; for Inspiration is performed when the *Thorax* is enlarged by the changing of the situation of the Ribs and *Sternum*, which renders its capacity more ample; and by the relaxation of the Diaphragme, which likewise diminishes the Capacity, because that it makes it to mount on high, and take up a part of the *Thorax*. Now this Relaxation, which is a thing passive, is not sufficient for the powerful effort that Expiration requires, because that the Air inclosed and compressed by the Action, which the Pectoral Muscles do cause in Respiration, would be capable of forcing the Diaphragme downwards, if not thrust upwards by some power which acts strongly in Expiration. This Power is double; one is that of the *Medi-stinum*, which after having been drawn and extended in the inspiration, when the center of the Diaphragme descends downwards, do's afterwards draw the same Center upwards, as do's Spring, which after having been forc'd returns to its first State, by an Action which *Galen* calls Natural, and which is not voluntary like that of the Muscles; so that he attributes to it the involuntary retraction which happens to the parts, by Muscles whose Antagonists have been cut. The other power which makes the Diaphragme to ascend, is that of the muscles of the lower Belly, which may pass for the Antagonists of the Diaphragme, when they do compress whatever is contained under the Diaphragme: For by this Action making the Liver, *Ventricle*, and other parts of the lower Belly to rise up, they force the middle of the Diaphragme upwards; which afterwards descends, when by its proper Action, which is Extension, it again takes the strait and flat figure which the Contraction of the Fibres do give it. This compression of the Muscles of the lower *Venter* on the *Viscera* is so powerful, that the *Ventricle* has been sometimes observed to have been push'd into the capacity of the *Thorax*, when the Diaphragme had received a great Wound: as *Paracelsus*, *Sennertus*, and *Hildanus* do testify.

By these Actions of the compression of the Muscles on the *Viscera* making them to ascend, and of that of the Diaphragme making them afterwards to descend, and by the continuity of these alternate Motions, it may be said that Respiration is, in respect of the the Humours contained in the lower *Venter*, what the Pulsation of the Heart is in regard of the blood contained in its *Ventricles*; that is to say, that this compression and agitation serves not only to the distribution of the Chyle, as that of the Heart serves to force the blood into the Arteries, but that it is one of the principal causes of the generation

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ration of the same Chyle, by the division, attenuation and mixture of the parts of the Food which this continual agitation is capable of producing.

These Actions which are essentially necessary for Life, and which must be performed in Birds as in terrestrial Animals, are there also perform'd by Respiration, altho' with different Organs; for tho' the Diaphragme of those Birds that have it musculous, or at least the Muscles of the Lungs in the *Ostrich*, has some Tension and Relaxation, by the means of which, the Lungs and its Bladders are compress'd, it has not that Motion which it has in terrestrial Animals, by which the *Viscera* are sometimes forc'd upwards, sometimes downwards; and the Muscles of the lower *Venter*, by reason of their smallness, cannot compress them but very feebly, because that almost all the lower Belly is covered with the *Sternum*, whose size must be exceeding great, as it is, to give rise to the great Muscles which do draw the Wing downwards; the force of these Muscles being unable to answer the powerful Action of flight, if they were less. So that this weakness of the Muscles of the lower *Venter* and Diaphragme; must be supply'd in Birds by the Bladders of the Lungs, which are alternately filled and emptied in their Respiration; and the manner of their acting is thus.

When the *Thorax* is dilated by the Action of the Pectoral Muscles, the Air enters into the Lungs, and at the same time from the Lungs into the Bladders; but it must be understood that it enters only into those which are inclosed in the *Thorax*, because that there is nothing which, by dilating the Bladders contained in the lower Belly, can give occasion to the Air to enter in; for on the contrary it is then that they shrink, and that the Air which they contain re-enters into the Lungs. But when afterwards the *Thorax* is compressed and contracted, the Air lockt up in the Bladders of the *Thorax*, being thereby squeezed out, one part goes out through the *Larynx*, the other enters into the Bladders of the lower Belly, and swells them at the same instant that the upper ones are evacuated; and afterwards when the upper Bladders are filled by the dilatation of the *Thorax*, they do receive, not only the outward Air thro' the *Larynx*, but also that of the Bladders of the lower Belly, which are compressed at the same time that the upper ones are dilated; and this happens to them, as well by reason that their Coats do return into their first state, by the force of their Spring as because that the *Viscera*, which have been forc'd and compressed by the dilatation of the Bladders, do in their turn force them, aided by the Muscles of the lower Belly, notwithstanding their smallness. This makes a Reciprocation and Vicissitude of Impulsions, which supplies the potent Action, produced by the great Muscles of the lower Belly, in terrestrial Animals. This Action of the Bladders, which serve for the Respiration of Birds, is plainly seen, when they are dissected alive. We have made the Experiment thereof in great Birds, as *Geese* and *Turkey-Cocks*, in which having open'd the lower Belly, without hurting the Bladders which are there; it was remarked that when the *Thorax* was depressed in the Expiration, the lower Bladders did swell; and that when it was dilated for Inspiration, they did shrink.

This particular manner which Birds have in their Respiration, may be explain'd by the Bellows of Forges, which seem to have been made after the

imitation of the Organs of the Respiration of Birds: For these Bellow's have a double capacity to receive the Air. The first is that, underneath, which receives the Air when the Bellows is opened, and this capacity represents the upper Bladders shut up in the *Thorax*. The second capacity is that above, which represents the Bladders of the lower Belly: For when the inferior capacity is contracted by the compression of the Bellows: The Air which it has received enters through a hole with which it is pierced, and passes into the upper capacity; so that the Air forceably thrust, do's enlarge this capacity, by making the upper board to rise; this hole being in the middle board between them, which is as it were a *Diaphragme* between the two Capacities that compose the Bellows, which are different from those of the Bladders of the Lungs of Birds, in that their situation is different; the capacity of the Bladders which do first receive the Air, being in the Superiour part in Birds, and in the Inferiour in the Bellows of Forges. The Society has likewise made on several other Birds some Remarks concerning the Respiration of these kinds of Animals, which will be found in their Descriptions.

The *Heart* was almost round, being six Inches from the *Basis* to the point, and five in breadth. Birds have it generally longer in proportion. The *Auricles* were small, and the *Ventricles* great. The Aperture of the *Vena Cava* was very large, without any Valves: There was only as it were a Sack, whose side (which was a partition between its Cavity and the Mouth of the *Vena Cava*) did serve for a Valve, which might be called *Sigmoides*. This Structure is common to the Heart of Birds. The other Valves were in the other Vessels of the Heart as usually.

The *Aorta* descended along the right side as in other Birds, being shut up in a *Capsula* formed by the *Aponeurosis* of the Muscles of the Lungs.

The *Skull* was soft: In one of the Subjects we found a Fracture. Naturalists have observed that when the *Ostrich* fears any danger, it thinks it self in safety, when it has hid its Head.

The *Cerebrum* with the *Cerebellum* was but two inches and a half long, and twenty Lines broad. The *Dura Mater* divided not the Brain in two by that large Production called the *Fals*; but in the Substance of the Brain there was observed only a small Ray somewhat deep, on which the *Dura Mater* was a little thickned, and applied to it making as it were a Seame.

The *Sinus Longitudinalis* went as vually from the forepart to the hind-part of the Head, to terminate at the meeting of the *Sinus Laterales*, which were fixed at the place where the *Dura Mater* separates the *Cerebrum* from the *Cerebellum*. These two *Sinus*'s came out of the Skull through some particular holes of the *Occiput*, to discharge themselves into the Internal Jugulars. The fourth *Sinus*, which was seated a great deal backward than in *Terrestrial* Animals, did obliquely descend downwards, and dividing into two Branches, entred into the *Ventricles* of the Brain.

The *Dura Mater* being taken away, we found the *Glandula Pinealis* layd upon the place where the *Cerebellum* is joyned to the *Cerebrum*: It was about the bigness of a little Pea: several Branches of the *Lacis Choroides* envelop'd it. The *Pia Mater* was strewed with a great Number of Vessels. The Surface of the Brain which it covered, was not divided into several Sinu-

fities

sities and Circumvolutions, but smooth and even, as it is commonly in Birds. The whole Anterior part of the Brain was divided into two parts, which were connected together only by some very slender *Fibres*. The separation of these two parts, which in *Terrestrial* Animals goes to the Callous Body, was absolutely of the whole Brain, which was united only by the Posterior Part, near the *Cerebellum*. This separation and division of the Brain into two Parts is found in most Birds; and it is well known by Quacks and Mountebanks, who gain a Reputation to their Balfome, by curing Hens, after having run a Knife through their Head, which they easily do between these two Parts of the Brain, without killing them. In each of these two Parts there was a Cavity or *Ventricle*, which was covered over with a white, medullary Substance, half a Line thick, which was also extended over the place by which these two parts are joyned together, and where the Anterior *Ventricles* did meet in a third. In this third there was a cleft terminating at the *Infundibulum* and *Glandula Pituitaria*, which exactly shut the end of the *Infundibulum* or Tunnel, being situated as usually on the *Os Sphenoides*. At the Posterior Part of the two Anterior *Ventricles* there was seen the *Lacis Choroideas* formed by a Branch of the *Carotide*, and a branch of the fourth *Sinus*. Almost all the Substance of the Brain was of an Ash-colour, and like to the Cortical Part of a Man's Brain, so that in proportion to that which is medullary, it was ten times bigger and thicker.

The ten Pairs of Nerves took their rise, and came out of the Skull after the same manner as in *Terrestrial* Animals.

The *Spinalis Medulla*, which took its Origine from the place where the two parts of the Anterior Brain are joyned together and with the *Cerebellum*, had at its sides two round Eminencies, about the bigness of a small Nut. They had each a considerable Cavity, and did Form as it were two *Ventricles*, opening themselves into the Inferiour *Quittus*, which passes under that which is called *Sylvius's* Bridg, and through which the *Serofities* of the *Cerebellum* are discharged into the *Infundibulum*.

In the *Cerebellum* the Cortical and Medullary Parts were disposed after the same manner as they are seen in *Terrestrial* Animals; these different Parts appearing on the outside to be ranged by Plates joyned to each other, and distinguished by parallel Lines. There were two *Apophyses Vermiformes* as in Man. There was also a *Ventricle* of the shape of a Pen, as in the generality of *Terrestrial* Animals. The *Cerebellum* on the inside was composed as ordinarily of a white Substance, like Branches of Trees, and of another red and livid Substance,

The Figure of the *Eye*, like as in other Birds and Fishes, was composed of two Semi-Globes, the greatest of which formed by the *Sclerotica* had its flat part before; the other, a great deal less, was laid on the flat of the *Sclerotica*. This little Semi-Globe was the *Cornea*, which had all round a raised Circle, making as it were a Border. The *Optick Nerve* did not enter at the middle, but a little at the side towards the Angle, which the convexity of the *Sclerotica* makes with the flat part. The *CrySTALLINE* had no kernel, but its Substance was uniform: It was more convex on the inside than on the out. The *Choroideas* was intirely black, without having in the bottom that

various coloured and as it were gilded Membrane, which we call the *Tapetum*.

The *Optick Nerve*, having pierced the *Sclerosica* and *Choroides*, was dilated, and formed as it were a Tunnel of a Substance like its own. This Tunnel is not ordinarily round in Birds, where we have almost always found the extremity of the Optick Nerve flatted and compressed on the inside of the Eye. From this Tunnel proceeded a folded Membrane, making as it were a Purse, which ended in a point towards the border of the *Crystalline*, nearest the entrance of the Optick Nerve. This Purse, being six Lines at the bottom, at its coming out of the Optick Nerve, and going pointwise towards the top, was fastened by its point to the border of the *Crystalline*, by means of the Membrane which covered it on the side of the *Vitreous Humour*, and which did also cover the whole Purse, that was black, but of another black than is that of the *Choroides*, which appeared like a Spot of Water Colours, which sticks to the Fingers: For the Colour penetrated the Membrane.

The upper *Glandula Lachrymalis*, which is commonly hid on the inside of the exterior Angle of the Orbit, was placed in a cavity sunk into that Part of the *Coronales* which goes to make the superiour part of the Orbit: It was eight Lines in length and four in breadth; its Tubes were disposed after the usual manner.



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THE REFORMATION OF THE LIVING AND DEAD

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The Explication of the Figure of the CASSOWARY.

THE lower Figure shews that the Head, Neck, and Bunch on the Breast are without Feathers; that the rest of the Body appears rather garnished with Hair than Feathers; that the fleshy Appendices, where-with the lower Beak of Hens is ordinarily deck'd, are in this Bird at the bottom of the Neck; that the Head is covered with a Crest like an Helmet; that the Beak is divided at the end; that instead of Feathers, the Wings have only five Quills without Beards; and that the Rump and Feet are extraordinary bigg.

In the Upper Figure.

- A A. Represents one of the Feathers, which are for the most part double.
 B. The Tongue with the knot of the Larynx.
 C. The Spleen.
 D. The Splenick Artery.
 E. The Splenick Vein.
 F. The Crow.
 G. The first Ventricle.
 H. The second Ventricle.
 I. An Appendix of the second Ventricle.
 F. The Head of the Appendix which stop'd the Pylorus.
 K. The Gall-Bladder.
 L L. The Ductus Cysticus.
 M M. The Ductus Hepaticus.
 N. The Pancreas.
 O Q. The Internal Eye-lidd extended over the Cornea.
 P Q P. The Internal Eye-lid drawn from over the Cornea, and brought into the great Canthus of the Eye.
 P S r Q. The great Muscles of the Internal Eye-lid; Q is its Origine; P, its Insertion; S, the Optick Nerve on which the Tendon of the Muscle is folded; r, the Aponeurosis of the little Muscle, which serves as a Pulley to the Tendon of the great one.
 R r. The little Muscle.
 T T. The Glandula Lacrymalis,
 V V. The Vessels of the Glandula Lacrymalis.
 X a. The Ductus Lacrymalis. X, is its Aperture towards the edge of the Internal Eye-lid, through which the Humour is poured on the Cornea.
 Y Z. The great Muscle extended; Z, is its Origine; Y its Insertion.
 a. The Trunk of the lower Vena Cava.
 bb. The Emulgents c c c c. The Kidneys.
 df, df. The Epididymis. e e. The Testicles.
 dg, dg. The Deferentia.
 gg gg. The Ureter's.

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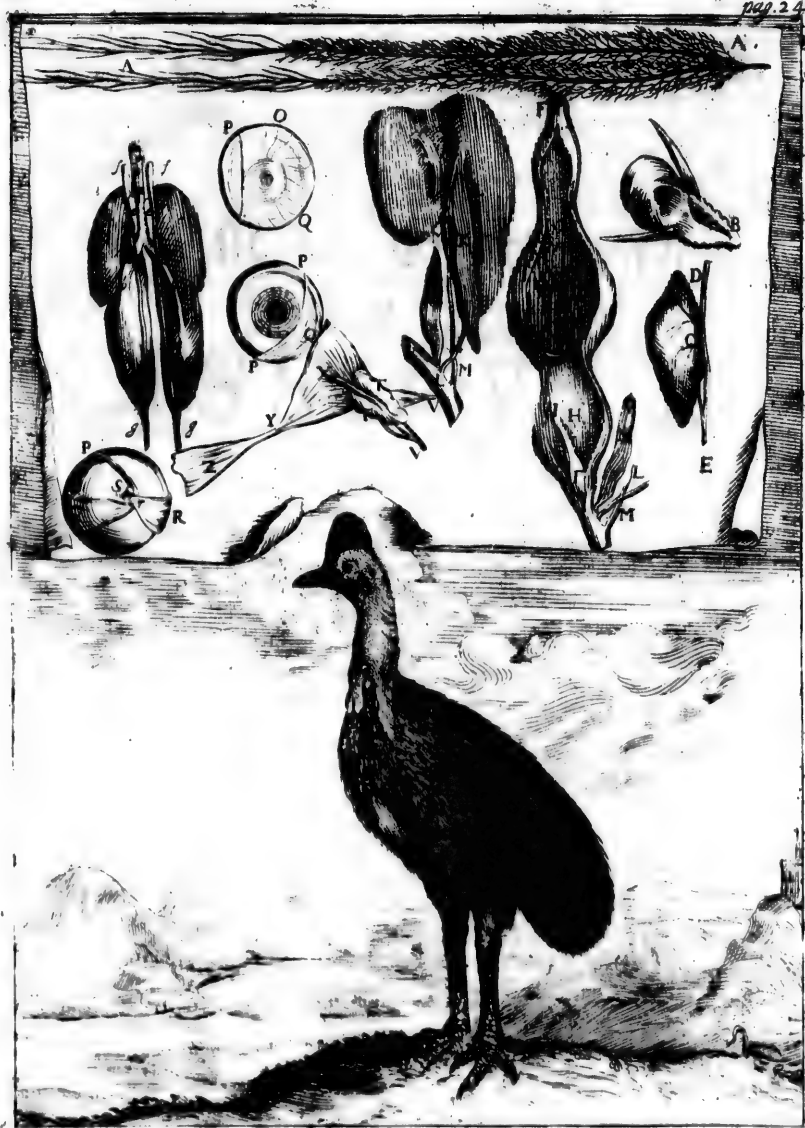
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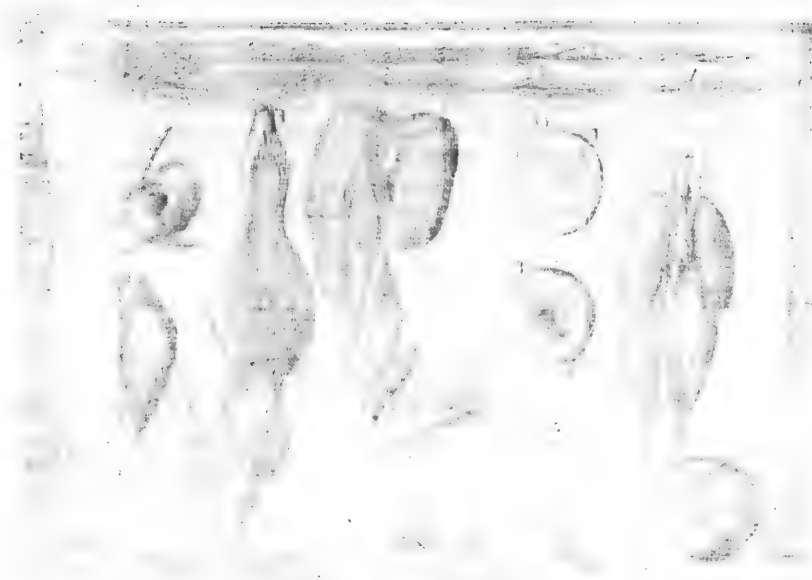
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THE
ANATOMICAL DESCRIPTION
OF A
CASSOWAR.

BEfore the year 1597 this Bird was never seen in *Europe*; and no Author of the Ancients, or Modernes, has spoken thereof. The *Hollanders* brought one at the return of their first Voyage from *India*. It was given them as a Rarity by a Prince of the Isle of *Java*. Six years after they brought two others, but they dyed on the way. That here described was sent to the King in 1671, by the Governour of *Madagascar*, who had bought it of the Marchants which returned from the *Indies*. It Lived four years at *Versailles*.

Clusius say's that in the *Indies* it is called *Eme*. We have not yet been able to understand wherefore it is in *French* called *Casuel* or *Gasuel*. This Bird, next the *Ostrich*, is the greatest, and weightiest of all that we know. That which *Clusius* describes, which is the first that the *Hollanders* brought from *India*, was a fourth less than ours, which measured five foot and a half in length, from the end of the Beak to the extremity of the Tailons. The legs were two foot and a half from the Belly to the end of the Tailons. The Head and Neck were a foot and a half together. The greatest Toe, comprehending the Nail, was five inches long; the Nail of the little Toe, three inches and a half. The Wing was so little, that it did not appear, being quite hid under the Feathers of the Back. *Aldrovandus*, who has only seen the description that is given thereof in the Relation of the first Voyage of the *Hollanders*, reports that this Bird is chiefly admirable in that it has neither Wings nor Tongue. In our Subject we found this a fallacie. This Author might also have added that it has no Feathers, because that indeed, those which do cover it, do better resemble the Hair of a Bear or wild-Boar, than Feathers, or Down; so harsh, long, and thin are the Fibres which do compose the Beards of these Plumes.

All these Plumes were of one sort, different from Birds which fly, where there are some feathers for flight, and others only for covering the Skin. Our *Cassowary* had only of the last sort. They were molt double, having two long Tubes or Stem's proceeding from another very short one, which was fastened to the Skin. *Clausius* says that they are always double. In our Subject there were a great many single. Those which were double, were always of an unequal length: Some were fourteen inches long. We have already remark'd this kind of feather in an *Eagle*, and a *Parrot*: But those of the *Cassowary* had three Particularities. The first is that the Beards, which did adorn the Stem from the half to the end, were long and harsh like Horse-Hair, without casting out any Fibres, and in this they are different from the Plumes of *Heron's*, whose long and slender beards are not of single Fibres as they do appear; for they are decked on each side with little Fibres, so short that they are almost imperceptible. The second particularity is, that in this half the Stem was not different from the Beards, being neither bigger nor of a different Colour, as is commonly in the Feathers of other Birds. The third particularity is that these Beards were perfectly black, and that those of the other half were of a Grayish Tawney, shorter, softer, and casting forth small Fibres like Downe. Now there was only this part, composed of great and black Fibres, that appeared, the other part composed of Down being covered over therewith. The different Hairs wherewith the Skin of *Cassows*, *Boars*, and other Animals which are Subject to wallow in the Mire is covered, are disposed after this manner for the uses which are explained in the description of the *Castor*.

The Neck was without feathers as in the *Indian-Cock*. The Head also had none: It had only some Hairs erected on the Crown, especially towards the hind part and on the Neck. There was no Tail; the feathers which did cover the Rump, which was extraordinary great, not being different from the others nor otherwise disposed.

The Wings, which without the feathers were not three inches in length, were covered with the same sort of Plumes, and did each cast forth five great Tubes or Stems without any Beards. *Clausius* puts down but four: They were of different length, according to the disposition, and proportion that the Fingers have in the Hand. The longest was eleven inches, being three lines Diameter towards the root, which was only a little bigger than the extremity, which went not pointing but did appear broken, or ragged. Their Colour was of a very shining black. We did not think these wings could serve to assist it to walk, as *Clausius* imagines; there being greater probability that it might be thereby aided to strike, as with Switches.

The Head appeared little as in the *Ostrich*, because that it was not enlarged with feathers, as in other Birds. It was covered with a Crest three inches high, like that of a Helmet. This Crest covered not all the Crown of the Head: For it began but a little beyond the Crown, and ended at the beginning of the Beak. It was of different Colours, the fore part being blackish, and the hinder part and sides of a Wax-Colour. It was every where smooth and shining like Horn. Its Circumference was like an edge, not exceeding three lines in that place; from thence it went enlarging, and towards its Basis was about an inch. Its Substance, which was very hard, appeared

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peared to us like Horne, being composed of several *Lamina* or Plates like the Hornes of Oxen. *Clusius* say's that when the Bird molts the Crest falls off with the Feathers: Which seemed to us incredible, considering the substance of the Crest, supposing that it was a Horne: for it was not of the Nature of *Deer's* Hornes which do shed, and grow again; and we made enquire, after this Particularity of those which do look after the animals of *Versailles* who for the space of four years, have not seen the Crest fallen. We did heartily wish that we had been permitted to examine by the dissection after what manner this Crest was joyned to the Skull; viz. whether the Skull sent forth any bony Production into the Cavity of the Crest, as it is observed that there are such in Hornes which are hollow, or whether it is a solid Body: but there was an expresse order from the King to preserve the Skin of this Animal, to adorn the Aviary of *Versailles*.

The upper part of the Beak was very hard, at its two edges and at top. The Interstices on each side had but one Membrane, in which were the holes of the Nostrills, very near the extremity of the Beak. This extremity of the Beak was divided in three, almost as in the *Indian-Cock*. The end of the lower Beak was slightly indented, being likewise divided in three. The whole Beak was of a dark-gray, except a green mark that the lower Beak had on each side towards the middle.

The Eye was large. Its Iris of a *Topaze* Colour, almost as in the *Lyon*. There was an internal Eye-lidd, which was hid in the great *Canthus*. The inferiour Eye-lidd, which was the largest, was garnished with a row of black Hairs. There were likewise a row of black Hairs like a Demi-circle, at the top of the Eye, raised like an Eye-brow. The hole of the Ear was very great and bare, being only furrounded with black Hairs, like the Eyes. There were of these very Hairs about the root of the Crest.

The two sides of the Head, round the Eye and Ear, were of a blewish Colour. The Neck was Purple, inclining to a Slate colour. Behind, it was also Red in several places, but especially towards the bottom; and these red places were raised a little higher than the rest, in wrinkles running obliquely cross the Neck. *Clusius* say's that there are Red Plumes towards the bottom of the Neck, which we have not found in our Subject.

At the bottom of the Neck there were two fleshy *Appendices*, like those which hang down at the lower Beak of *Hen's*. They were an inch and a half long, and nine lines broad, being rounded at the end. Their colour was like the rest of the Neck, partly red and partly blew.

At the middle of the Breast there was a place without Feathers, about six inches long, of an oval Figure, a little Pointed at the top. This place was a *Callosity*, on which the Bird did rest, as do's the *Camel*. It was composed of a dry Skin, fastened to a bonie Ligament, very thin, applyed and fixed on the middle of the *Sternum*, by Fibres mixt with Fat, so that all this *Callosity* was moveable.

The Thigh's were covered with feathers. The Leggs, which were extraordinary great, strong and strait, had some Scales. There were some *Hexagonal*, *Pentagonal*, and square. Towards the top and hinder-part of the Leg they were small, towards the bottom and fore-part they contained even an inch: On the Instep they were like plates, two inches long. The Toes were likewise

covered with Scales. They were but three in number, having none behind: the least was on the inside. The Claws were of a hard and solid substance, black on the outside, and white on the inside. They were half worn away. *Clusius* say's that this Bird has a prodigious strength in his Feet, with which it strikes, by running backward, in such sort, that it breaks down Trunks of Trees of the bigness of ones thigh. Those that had the care of ours, observed it not to be so strong nor Furious: they have only remarked that it persued after Women with great hatred.

The *Oesophagus* from the *Pharynx* to the beginning of the *Craw*, measured ten inches long: it was an inch and half large. The Tunicles whereof it was composed were thick. Before the entrance into the Stomach, it was enlarged and grew thinner, making a *Craw*, which, as in *Hen's* and *Pidgeons*, was half on the bottom of the Breast, and half in the *Thorax*. This *Craw* was eight inches in length, and four in breadth: At the straitest place it was two. It was succeeded by a second *Craw* more gross, and composed of Tunicles more thick. This *Craw* was a foot long, and seven inches broad. It descended underneath the Liver. Its interior Tunicle was composed of Glands, as the extremity of the *Oesophagus* commonly is in Birds; and these Glands, which are not so large, nor so well formed as in the *Bustard*, which is the only Bird in which we have found them most distinct, were covered over with a yellow Velvet. This particularity makes that this *Craw* may be taken for the first *Ventricle*, which was followed by a second composed of thinner Tunicles than those of the first. The internal Tunicle appeared thick because that it was plaited. The Velvet which covered it, was a little thicker than in the first *Ventricle*. These two *Ventricles* were separated, and distinguished one from the other, not only by their Substance, which was different, and by a Contraction such as is seen in the different Ventricles of Animals which Chew the Cud, but likewise by a Membranous border made like a Valve.

From the middle of the second *Ventricle* there proceeded, on the inside, an *Appendix* three inches long, and eight broad; 'twas a Production of the Internal Membrane of the *Ventricle*. At the end of this *Appendix*, there was as it were a Head, of the bigness of a *Pullets* Egg, which drawing the *Appendix* downwards, descended into the *Pylorus*, and stopt it. There is ground to doubt whether this formation was Natural, or caused by distemper. We have nevertheless thought that it was not Natural, and that there was formed in the internal Membrane of the *Ventricle* a *Scirrhus*, which by its weight having insensibly extended it, had formed this *Appendix*, whose extremity, great and hard as it was, might have caused the Death of this Animal, which fifteen days before its Decease, had undergone a kind of Vomiting of whiteish water, even to a *Chopine* or *Parisian* half Pint a day; which was in appearance its Nourishment, which could not find passage.

'Tis a thing very remarkable that this Animal, which feeds not on Flesh, but Pulse and Bread, had not a fleshy and musculous Gizzard, as all other Birds which feed on that sort of Nourishment use to have; considering also that in every thing else it has so much resemblance with the *Ostrich*, which has a Gizzard: and that like it, it swallows whatever is offered to it, even to burning Coals, according to *Clusius*; and it must be thought, that Nature

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has supplied the defect of the Gizzard, by the multitude of the *Ventricles* that it has given it, provided with a qualitie particuler, and capable of dissolving the hardest and most solid Aliments. This has seem'd credible to considering in what state the two *Ventricles* and *Craw* were found: For the *Ventricles* were quite empty, having only the *Craw* that had any thing in it, and the Nourishment which it contain'd was more than half digested. Which made us to judge of the strength that these *Ventricles* must commonly have, seeing that their *Craw* had so much thereof in one dying Animal.

The *Intestines*, were in all four foot eight inches long, and two inches diameter. They were all of one breadth and Substance, without leaves on the inside, without Cells and without a *Cacum*.

The Liver was of a moderate size the right Lobe being only eight inches and the left four. It was every where Scirrhus. The Gall Bladder which was fastened along the right Lobe, and shut up in the *Capsula*, was seven inches long, and an inch diameter at most. The *Ductus Cysticus*, which proceeded from the top of the Bladder, measured eight inches in length, and was enlarged towards its insertion, which was towards the beginning of the *Duodenum*. The *Hepaticus* was eight inches and a half, and descended from left to right, and the *Cysticus* from right to left, which made that these two *Ductus*'s increased towards their lower part. The *Hepaticus* was inserted underneath the *Cysticus*.

The *Spleen* was three inches long, and an inch and a half broad at its greatest breadth: It had the shape of a *Sole-Fish*. Its Vessels were distributed as usually.

The *Pancreas* was little in proportion to the other parts. It was but two inches in length and two lines in breadth. Its *Ductus*, which was very slender was but one line and a half long, and was inserted above the *Cysticus*.

The *Kidneys*, as in other Birds, were divided into several Lobes. They measured eight inches in length. The *Ureter*'s were of the bigness of a *Goose-Quill*, and seven inches long.

The *Testicles* were an inch in length, and half an inch in breadth. Their Substance was white and hard, and much different from that of the *Epididymis* which was soft and yellowish; but the size was very extraordinary, being three inches long and two lines broad; so that it was raised two inches above the *Testicle*. The *Ductus Deferens* descended along the Kidney, being fastened to the *Vena Emulgens*, and afterwards uniting it selfe to the *Ureter*. It was eleven inches long, having the bigness of a *Quill*. The *Penis* was placed as in the *Ostrich*. It comprehended two inches in length, an inch in breadth towards its Basis, and two lines towards its point. The Skin which covered it was hard, thick and unequal on the inside, by reason of several folds which were disposed like a Screw. The Body of the *Penis* consisted of two Cartilaginous Ligaments, which gave a Piramidal Figure to the *Penis*. They were very hard and solid, and strongly connected to each other at the top. They were separated underneath, to give place to a Membranous *Ductus*, with which we could not perceive that the *Deferentia* or *Ureter*'s had any communication.

The Lungs measured eight inches in length and four in breadth over their middle.

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This Bird being the largest that we have dissected next the *Ostrich*, we applied our selves to observe some things which do appertain to the Organs of Respiration, which have a particular Structure in Birds, and which we begun to discover in the *Ostrich*: For it is not easy to perceive well these things in lesser Birds. Amongst other things we examined two Muscles, which we do call the Muscles of the Lungs. These Muscles had their Origin very fleshy, which in each was divided into six Heads, each fastned to a Ribb, at the place where the Ribb, which by one end is articulated with the *Vertebra*, is by the other articulated with another Ribb which is joyned to the *Sternum*. For it must be observed that the Ribbs of Birds are ordinarily double; and that whereas in Terrestrial Animals, there are some Cartilaginous Appendices which do fasten them to the *Sternum*, they are in Birds real Bones, which are articulated and not joyned *per Symphysin* with the Ribbs. Now these six Heads of the Muscle of the Lungs did all together produce a large Tendon or *Aponeurosis* which covered the Lungs, and which separated it from the Bladders, into which the Air, after having penetrated the Lungs, enters through the holes with which this *Aponeurosis* is pierced; and these Bladders were again covered over by the *Diaphragme*, even as the Lungs was by the *Aponeurosis*: So that the Bladders were shut up between the *Aponeurosis* and the Ribbs. This *Aponeurosis* thus lay'd upon the Lungs, went to joyn it self with the *Aponeurosis* of the opposite Muscle on the *Vertebra*, to which it was also strongly connected; leaving nevertheless upon the middle of the Body of the *Vertebra*, a void space for the passage of the descendent *Aorta*, and *Oesophagus*. At the same place where these *Aponeuroses* were connected together, and fastned to the *Vertebra*, the *Diaphragmes* were also joyned, and united to the *Aponeuroses*; but towards the left side they gave way to a great branch of the *Aorta*, which supplied the place of the *Culica* and *Mesenterica*. This Branch was crept between all these *Aponeuroses*, as well of the Muscles of the Lungs, as of the *Diaphragmes*; which were joyned together.

The use of these Muscles according to our Conjectures, is twofold. The first is to serve the Motion of the *Therax*, by drawing it downwards; because that they do go from the Angle which the Ribbs make, by their mutual articulation, and do obliquely ascend towards the inferiour *Vertebra* of the Back, to which they are fastned. The second use is to retain the Air lockt up in the Pouches or Bladders, and hinder it from going out with the same liberty that it entered in. The use of this Retention is not well known to us, at least in respect of the upper Pouches: For in regard of the lower ones, the use of this Retention has been explained in the Description of the *Ostrich*, where it was shewn, that there is a probability that the Air contained in the lower Pouches serves to compress the *Viscera*, and make them rise upwards. Some do think that this Retention of the Air serves Birds to render them lighter in flying, like as the Bladder which is in Fish helps them to Swim. And this Conjecture would have some foundation, if the Air contained in the Bladders of Birds was as light in proportion to the Air in which they Fly, as the Air contained in the Bladders of Fish is in proportion to the Water in which they do Swim. But to say something, which hath at least a little more probability, waiting till we have a more certain know-

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ledge of the Truth and use of this retention of Air, we consider that the Birds generally rising very high, and even to the place where the Air is a great deal lighter than it is near the Earth, might be deprived of the principal advantages of Respiration, for want of an Air, whose weight might make on the Heart and Arteries the Compression necessary to the Distribution and Circulation of the Blood; if they had not the faculty of containing a long time a portion of Air, which, being rarified by the heat which this Retention produceth therein might, by enlarging it self, supply the defect of the weight, of which the Air that they do breath in the middle Region is destitute. For if there are a great many Birds which do never rise very high into the Air, whose Lungs have notwithstanding these Bladders in which the Air is retained; there are also a great many that have Wings, which they use not for flying: And it may be observed that there are found some parts in Animals, which have not any use in certain Species, and which are given to the whole Genus, by reason that they have an important use in some of the Species. 'Tis thus that in several kinds of Animals, the Males have Testes like the Females, that Moles have Eyes, Ostriches and Cassowars Wings, and that Land-Tortoises have a particular Formation of the Vessels of the Heart, which agrees only with Water-Tortoises, as it is explained in the Description of the Tortoise.

However it be, the structure of the Muscles of the Lungs gives occasion to believe that they do serve to this Retention, because it is seen that the holes which they have, to give entrance into the Pouches, are most in the fleshy part of the Muscles, which is capable of a voluntary Constriction and Relaxation. And moreover this Retention of the Air is manifest in the Camelion, which hath Lungs of a Structure like that of Birds: For we have remark'd that the Camelion is sometimes swelled, as it was ready to burst, and continues a long time in this posture, altho' the Reciprocation of the Respiration ceases not from going its usual pace; as if by the means of these Muscles of the Lungs, this Animal did retain the Air in some of the Bladders, viz. in those whole Apertures are in the fleshy part of the Muscle; and that in the others it leaves a free Egress and Entrance to the Air for Respiration.

In the middle of the two great Diaphragmes, there was a Membrane, which, like a *Mediastinum*, descended from top to bottom, and which served for a Ligament, to suspend the Heart, Liver, *Ventricle*, and the rest of the parts of the lower *Venter*.

The Bladders of the Lungs were separable from the Diaphragmes and Muscles of the Lungs, each having their particular Tunicle. These Tunicles were joyned together, making double and not single partitions. The second Bladder had two holes. The fourth descended not so low as in other Birds, by reason that the *Sternum* being very small, and consequently the Muscles of the lower *Venter* greater than ordinary, this Bladder was not so necessary as in Birds which have the *Sternum* bigger: which confirms the opinion that we have of the use which we attribute to this fourth Bladder, and which is explained in the Description of the Ostrich. Now the *Sternum* was proportionably lesser than in the Ostrich, because that the Muscles de-

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signed for the Motion of the Wings, to which it gives rise, were very small, and proportioned to the Wings.

The *Heart* was an Inch and half long, and an Inch broad towards its *Basis*. Its fleshy valve made a Sack, that was but one Line deep,

The *Tongue* measured an Inch in length and eight Lines in breadth. It was indented all round like a Cocks Combe. *Aldrovandus* has said that the *Cassowary* has neither Wings nor Tongue, instead of saying that these parts are of a structure altogether extraordinary in this Bird.

The *Globe* of the *Eye* was very bigg, in proportion to the *Cornea*, being an Inch and half Diameter, and the *Cornea* but three Lines. The *CrySTALLINE* was four. The black Purse which proceeds from the *Optick Nerve*, was as usually in other Birds.

In this Subject we applyed our selves exactly to remark what belongs to the internal Eye-lid, which we have found in the Eyes of all Birds, and in those of the generality of *Terrestrial* Animals. The particularities of the admirable structure of this Eye-lid, are such things as do distinctly discover the wisdom of Nature, amongst a thousand others of which we perceive not the contrivance, because we understand them only by the Effects, of which we know not the Causes: But we here treat of a Machine, all the parts whereof are visible, and which need only to be lookt upon, to discover the Reasons of its Motion and Action.

This internal Eye-lid in Birds is a Membranous part, which is extended over the *Cornea*, when it is drawn upon it like a Curtain, by a little Cord or Tendon; and which is drawn back again into the great Corner of the Eye, to uncover the *Cornea*, by the means of the very strong Ligaments that it has, and which in drawing it back towards their Origine, do fold it up. It made a Triangle when extended, and it had the figure of a Crescent when folded up. Its *Basis*, which is its Origine, was towards the great Corner of the Eye, at the edg of the great Circle which the *Sclerotica* Forms, when it is flatted before, making an Angle with its Anterior part, which is flat, and on which the *Cornea* is raised, making a Convexitie. This *Basis*, which is the part immovable, and fastned to the edg of the *Sclerotica*, did take up more than a third of the Circumference of the great Circle of the *Sclerotica*. The side of the Triangle, which is towards the little corner of the Eye, and which is moveable, was reinforced with a border, which supplys the place of the *Tarsus*, and which is black in most Quadrupeds. This side of the Eye-lid is that which is drawn back into the Corner of the Eye by the Action of the *Fibres* of the whole Eye-lid, which parting from its Origine, proceed to joyn themselves to its *Tarsus*.

To extend this Eye-lid over the *Cornea*, there were two Muscles that were seen when the fix were taken away, which served to the motion of the whole Eye. We found that the greatest of these two Muscles has its Origine at the very edg of the great Circle of the *Sclerotica*, towards the great corner from whence the Eye-lid takes its original. It is very fleshy in its beginning, which is a large *Basis*, from whence coming insensibly to contract it self by passing under the *Globe* of the Eye, like as the Eye-lid passes over it, it approaches the *Optick Nerve*, where it produces a Tendon round and slender, so that it passes thro the Tendon of the other Muscle, which serves

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for a Pulley, and which hinders it from pressing the Optick Nerve, on which it is bent, and makes an Angle, to pass thro' the upper part of the Eye; and coming out from underneath the Eye, to insert it self at the corner of the Membrane which makes the internal Eye-lid. This second Muscle has its Origine at the same circle of the *Sclerotica*, but opposite to the first, towards the little corner of the Eye; and passing under the Eye like the other, goes to meet it, and imbrace its Tendon, as it has been declared.

The Action of these two Muscles is, in respect to the first, to draw, by means of its Cord or Tendon, the corner of the internal Eye-lid, and to extend it over the *Cornea*. As to the second Muscle, its Action is, by making its Tendon to approach towards its Origine, to hinder the Cord of the first Muscle, which it imbraces, from hurting the Optick Nerve; but its principal use is to assist the Action of the first Muscle. And 'tis herein that the Mechanisme is marvelous in this Structure, which makes that these two Muscles joyned together, do draw much farther than if it had but one: For the inflexion of the Cord of the first Muscle, which causes it to make an Angle on the Optick Nerve, is made only for this end; and a single Muscle with a strait Tendon, had been sufficient, if it had power to draw far enough. But the Traction which must make the Eye-lid to extend over the whole *Cornea* being necessarily great, it could not be done but by a very long Muscle; and such a Muscle not being able to be lodged in the Eye all its length, there was no better way than to supply the Action of a long Muscle by that of two indifferent ones, and by bending one of them, to give it the greater length in a little space. The inspection of the Figure will serve greatly to the understanding of this Description, which the novelty of the thing renders obscure in it self.

The use of this internal Eye-lid, which till now has been described by no person, is not determined. Our Opinion is that it serves to clean the *Cornea*, and to hinder that by drying, it grow not less transparent. Man and the *Ape*, which are the sole Animals where we have not found this Eye-lid, have not wanted this precaution for the cleansing their Eyes, because that they have hands with which they may, by rubbing their Eye-lids, express the humidity which they contain, and which they let out through the *Ductus Lacrymalis*: which is known by experience, when the sight is darkened, or when the Eyes suffer any pain, or itching: For these Accidents do cease, when the Eyes are rubbed.

But the Dissection has distinctly discovered to us the Organs which do particularly serve for this use, and which are otherwise in Birds than in Man, where the *Ductus* passes not beyond the *Glandula Lacrymalis*. For in Birds it goes beyond; and penetrating above half way on the internal Eye-lid, it is opened underneath upon the Eye; which is evidently done to spread a Liquor over the whole *Cornea*, when this Eye-lid passes and repasses: as we observed it to do every moment.

The Explication of the Figure of the TORTOISE.

THis *Tortoise* has several particularities, which do render it different from those that we have in *France*. Its shell is not flat, but very convex. It has but one Shell to cover its Back and Belly. Its Tail is furnished with a Horn at the end. Its Paws are not covered with Scales, but with a Skin wrinkled like *Spanish Leather*. Its Claws are not sharp, but blunt and half worn away, and its Jaws toothed like a Saw.

In the Upper Figure.

- A B C D. The right side of the Liver.
 A. A little Lobe which covers the Bladder.
 B. The Bladder.
 C. The Trunk of the Vena Porta.
 D. The right Ramus Hepaticus.
 E F G. The left part of the Liver.
 E. The left Ramus Hepaticus.
 F. The Isthmus by which the left and right part of the Liver are joyned together.
 G. The great Lobe of the left part of the Liver.
 H H. The right Vena Cava.
 I I. The left Vena Cava.
 K. The Ductus Cysticus.
 L. The Trunk of the Rami Hepatici.
 M M. The Kidneys.
 N N. The Venz Emulgentes, to which are fastened two Glands.
 O O. The Testicles.
 P P. The Epididymides proceeding from the Kidney, and fastened to the Testicles by little Ductus's.
 Q Q. The Ureter's.
 R R. The Bladder opened.
 S. The Neck of the Bladder opened, offering to the sight two Carunculae, which are the extremities of the Ureter's, and two others which are the extremities of the Deferentia.
 T T. Two holes, which are of the Origine as the Spongius Ligaments, composing the body of the Penis.
 V V. A large Muscle, which includes the Rectum and Penis.
 X X. Two other Muscles of the Penis, which are interlaced with two others marked y y.
 Y. The extremity of the Glans.
 Z. The great circular Appendix.
 Δ. The little Appendix with its two Buttons.
 Φ Φ. The extremity of the Rectum cut lengthwise, to discover the body of the Penis.
 Θ. An Aperture between the two Ligaments, on which abuts the Neck of the Bladder.

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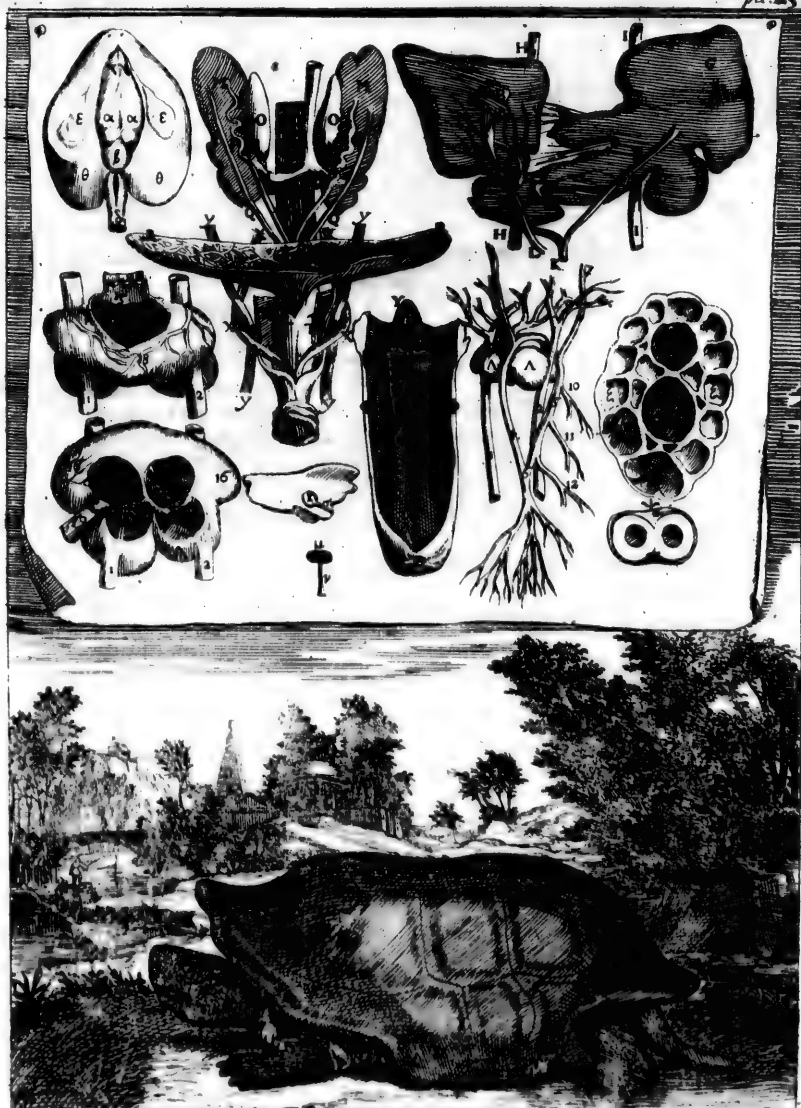
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- ψ. The Penis cut a cross, to discover the Cavities of the two Ligaments marked ω ω, and the Cavity which supplies the place of the Urethra marked π.
- Ω Ω Ω Ω. The great Ductus's of the Lungs.
- ξ ξ ξ. The Bladders opening into the Ductus's.
- Λ Λ. The Auricles of the Heart seen on the side which touches the Back-bone.
1. The Trunk of the left Vena Cava.
 2. The Trunk of the right Vena Cava..
 3. The Trunk of the Aorta at the going out of the Heart, forming two Crosses.
 4. The left Aorta.
 5. The right Aorta.
 6. The conjunction of the two Aortas..
 - 7 7. The Carotides.
 8. The Artery of the Lungs.
 - 9 9. The Veins of the Lungs which are discharged into the Axillares.
 10. The Artery which goes to the Stomack.
 11. The Artery which goes to the Liver, Pancras, Spleen, &c.
 12. The Artery which goes to the Intestines.
 13. The Heart in its Natural Situation.
 14. The Anterior Ventricle of the Heart.
 15. The Artery of the Lungs opened, to shew its three Valvulæ Sigmoides.
 16. 16. The Heart out of its Natural Situation, being raised upwards, and separated from its Auricles Λ Λ, which are in their place.
 17. 18. The two Posterior Ventricles of the Heart.
 19. The Aorta proceeding from the right Ventricle. It is opened to represent its three Valvulæ Sigmoides.
 - 20, 20, 20. The three Valvulæ Sigmoides, which are at the entrance of the Auricles of the Heart.
 - a b. Two holes which are the extremities of the Ductus by which the two Posterior Ventricles do communicate.
 - c d. Two other holes which do make the Communication of the Posterior left Ventricle with the Anterior.
 - α α. The Cerebrum.
 - β. The Cerebellum.
 - γ γ. The Olfactory Nerves.
 - δ. The Medulla Spinalis.
 - ε ε. The Musculi Crotaphitæ cut.
 - θ θ. The Os Occipitis.
 - κ. The Cartilaginous Plate or Film which stops the hole of the Ear.
 - τ. A Ductus which descends into the Palate.
 - υ. The Plate or Film sustained by the long Stylus marked ν.

THE
ANATOMICAL DESCRIPTION
OF A GREAT
INDIAN
TORTOISE.

THis *Tortoise* was brought from the *Indies*; it was taken on the Coast of *Coromandel*. It was four Foot and a half long from the extremity of the Mouth to the end of the Tail, and fourteen Inches thick. The Shell contained three Foot in length, and two in breadth. How great soever this *Tortoise* was, it came not near those of which *Eliau* and *Pliny* do speak, which were fifteen Cubits, and every one of which was sufficient to cover a large Cabine where several persons might lodge: But our's was a *Land-Tortoise*, and those that *Pliny* and *Eliau* do make mention of, were *Sea-Tortoises*, where Animals do generally grow much larger than those of the same Species which do live upon land. *Eliau* declares that *Land-Tortoises* are not ordinarily greater than the large Clods turned up by the Plow when the Land is light. The largest *Sea-Tortoises* which they do take near the *Antilles*, according to the relations we have had thereof, are not above as bigg again as ours.

The Shell and all the rest of the Animal was of the same Colour, viz. of a very dark Gray. The upper part was composed of several pieces of a different Figure, tho' the most part were *Pentagonal*. All these pieces were fix'd and joyned unto a Bone, which like a Skull, enclosed the Intrails of the Animal, having one Aperture before, to let out the Head, Shoulders and fore-Leggs; and another opposite, thro' which came out the hinder Leggs and Thighs. This Bone on which the Scales were fastned, was a Line and half in the thinnest place; and near an Inch and half in some places. It is generally double, there being one upon the back and another under the belly, which, like two Breath-Plates or Bucklers, are joyned by the sides, and ty-

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ed together by strong and hard Ligaments, but which do nevertheless grant liberty for any Motion. *Eliau* tells us that *Land-Tortoises* do cast their Shell, instead of laying their Shells, that is to say, those pieces which are fixed on the Bone made after the manner of a Skull. For there is no probability that a *Tortoise* should separate it self from this Bone to which all its principal parts are fastned. And it is true that these pieces are of themselves loosened from this Bone, when the Shell has been somtime kept, and the Bone begins to putrify; otherwise, to unloose them you must lay the Bone upon the Fire, the heat of which makes these parts easily to separate from each other.

At the great Aperture before, there was at the top a raised border, to grant more liberty to the Neck and Head for lifting themselves upwards: And this Inflexion of the Neck is of great use to the *Tortoise*: For it serves them to turn again when they are upon their Back. And their Industry upon this account is very admirable. We have observed in a living *Tortoise*, that being turned upon his Back, and not being able to make use of his Paws for the turning himself, because that they could bend only towards the Belly, it could help it self only by its Neck and Head, which it turned sometimes on one side, and sometimes on the other, by pushing against the ground to rock it self as in a Cradle, to find out the side, towards which the inequality of the Ground might more easily permit it to roul its Shell, for when it had found it, it made all its endeavours on that side.

The three great pieces of the Shell were upon the Back forwards; they had each in their middle a round Bunch standing up three or four Lines, and an Inch and half broad: The lower part of the Belly was a little hollow; Authors have taken notice that this Cavity is peculiar to the Males. Upon the Back there was a wound, occasioned by some blow that it had received when it was taken. This wound which pierc'd only the Shell and part of the Bone which sustained it, without penetrating on the inside, was not healed within more then a year which she lived, after her being taken.

All that proceeded out of the Shell, *viz.* the Head, Shoulders, fore-Leggs, Tail, Buttocks and hind-Leggs, were all covered with a loose Skin, folded in great wrinkles, and besides that grained like *Spanish Leather*. This Skin did not enter under the Shell, to cover the parts which are there enclosed, but it was fastned about the edge of each of the two Apertures: The Skin of *Sea-Tortoises* is covered all along the Leggs with little Scales like Fishes.

Albertus says that great *Tortoises* have a Shell over their Head in form of a Buckler. The Head of our *Tortoise* was only covered with a Skin, which was much thinner than that of the other parts. It was seven Inches in length and five in breadth, and did in some measure resemble the Head of a Serpent. The lower Jaw was near as thick as the upper. There were no Apertures for the Ears. The Nostrels were opened at the end of the Mouth by two little round holes, after a uncouth manner. The Eyes were small and frightfull: But we have observed nothing in respect of the *Tortoise*, which may make us to comprehend why *Gilius* and *Gesner*, in translating the words *ελοτα'η'ιεν*, which *Eliau* makes use of to express the deformity of the *Tortoise*, have rendered it *Crispissima aspectu*, instead of *Aspectu admodum Torvo*: For the *Greek* signifies both, and the interpretation of the Translators of *Eliau* has nothing of the sense, as the other, which agree with the Description of

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Pacuvius, who says that the *Tortoise* is *truci aspectu*. The Eye had no upper Eye-lid, being shut only by the means of the lower, which is lifted up to the Eye-brow. *Pliny* reports that this is common to all oviparous *Quadrupeds*.

Towards the extremity of the Jaw-bones, at the place of the Lipps, the Skin was hard as a Horn, and keen as in other *Tortoises*; but these Lipps were jagged like a Saw, and it wanted not on the inside two rows of real Teeth, although *Pliny* affirms that *Tortoises* have neither Teeth nor Tongue.

On each of the fore-Paws it had five Toes, or rather five Nails; for the Toes were not distinguish'd otherwise than by the Nails, these Paws having at the end but one round Mass, from whence the Nails grew out: The hinder-Leggs had only four. Both the fore and hind-Leggs were very short. The fore ones contained but 9 Inches in length, from the Top of the Shoulder to the End of the Nails, and hinder Legs eleven, from the Knee to the end of the Nails. The Nails were long, being an Inch and Half. They were rounded away both above and below, their cutt making an Oval figure; they were blunt and worn away. Their Colour was parti-coloured of black and white, in different places, and without any order. We have observed that *Sea-Tortoises* have Claws or Nails much sharper, because that they do not wear them in Swimming, as *Land-Tortoises* do in Crawling: We have found some that had only four Nails on the fore-Feet even as on those behind. *Albertus* tells us, that there are always five on each Foot. We have remark'd that tho the *Tortoise* goes slowly, yet the manner of going which is peculiar to it, must wear out its Claws as much as in Animals which run: For it rubs them all against the Earth singly and one after another; so that when it puts down one Paw, it rests at first only upon the hindmost Nail, then on the next, and so passes to the others, even to the fore-Claw by turning its Paw, which is round and bordered with Nails; like a Chariot, which moves its wheels, and imprints the heads of the Nails with which their Circumference is bordred, and makes them to enter into the Earth one after the other.

The Tail was large, having at its beginning six Inches Diameter. It was fourteen Inches long, and terminated in a point like an Oxe's Horn. *Cardan* calls it a Nail, which he likens to the Spurr which is behind a Cock's Foot, and thinks that it is a Callosity engendred at the end of the Tail of *Tortoises*, which have been formerly cutt off: which is not probable; a *Calculus* not being able to obtain a Figure so Regular, and so exactly rounded as it was in the Tail of our *Tortoise*. This Tail after the Death of the *Tortoise* was turned on one side, and so inflexible, that it could never be made strait, what force soever was used. The same inflexibility was found in the Muscles of the Jaws, which could not be opened otherwise than by cutting the Muscles. *Aristotle* has observed that of all Animals, the *Tortoise* is that which hath most strength in his Jaws: For its Force is such, that it cuts in sunder whatever it lays hold on, even to the hardest Flints. We have taken notice, in a small *Tortoise*, that its Head, half an hour after its being cut off, did make its Jaws to clack with a Noise like to that of Castanetts: The stiffness of the Tail, equalling that of the Jaws, makes it evident that the *Tortoise* has a great deal of strength in this part to strike with; and that this Horn which it has at the end may serve instead of an offensive Weapon.

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After having sawed on both the sides, the Bone which in manner of a Skull, makes the Cavity in which the Entrails are enclosed, as has been said: And after having quite cutt away a Membrane adhering to the part of this Bone which is underneath, and which makes the Belly, (this Membrane supplying the place of the *Peritonæum* towards the bottom, and of the *Pleura* towards the top) the Internal parts which presented themselves to view, were the *Ventricle*, *Liver* and *Bladder*, whose greatness was such, that it covered the *Intestines*, and all the other parts of the lower Belly.

The *Ventricle* was placed underneath the *Liver*, to which it was fastned by means of several Vessels. It was nine Inches long, and three diameter. Its Tunicles were very thick, its Orifices strait, and the Membrane which makes the Velvet was folded and bearing forms like Leaves extended according to its length. It had the Figure of the *Ventricle* of a Dog; *Severinus* attributes to it that of the *Ventricle* of a Man.

At the end of the *Ventricle*, the *Intestine* which one may call the *Duodenum*, had in its inner side Plaits or Folds like the *Ventricle*. Their Figure was Reticular; which might give occasion to believe that it was a second *Ventricle*. The rest of the *Intestines* were composed of very thick Membranes. The small-Gutts were one Inch diameter, and nine Foot long: The Valve of the *Colon* was formed by a circular fold of the Internal Membrane of the *Ileum*. There was not found in the *Uterum*, nor *Colon*, the Leaves that we have observed in the generality of Animals. We found no *Cæcum*. *Severinus* attributes two *Cæcums* to the *Tortoise*, resembling those which are found in Birds. The *Rectum*, at nine Inches distance from the *Anus*, had a contraction like the Rump of a *Hen*, round which there were three round Appendices of a different size, which seem'd formed by the Internal Membrane of the *Rectum*; and which were covered over with fleshy Fibres extended according to the length of the Appendices. The rest of the *Rectum* which reached from the contraction to the *Anus*, did serve as a Case to the *Penis*, as is observed in the *Castor*, *Civet-Cat*, and several other Animals. Among the small *Water Tortoises* we have dissected; there was found towards the extremity of the *Rectum*, two Bladders, which had communication with the *Intestine*, and which swelled when that was blow'n up. These Bladders have not been found in great *Tortoises*.

The *Liver* was of a solid Substance, but its colour pale; it was of a considerable bigness, and seemed as if it were double, being separated into a right and left part, which were joyned together only by an *Isthmus* of one Inch broad, and by Membranes which did convey Vessels from the left part to the right. Each of these parts had a *Vena Cava* proceeding out of the Convexity which faceth the *Diaphragme*, and each of them a *Ramus Hepaticus* going out of the hollow part. The left part of the *Liver* was the greatest, being divided into four Lobes: The first and biggest was on the left side: The second, whose bigness was of a middle size, was under the first. The third, which was somewhat lesser, was extended towards the right part, and produced the *Isthmus* by which the two parts were joyned together. The fourth was lengthened like as the third, over which it was situated, to go joyn it self to the right part, to which it was fastned only by a Membrane and some Vessels, which this Membrane did convey from one part to the other; such a like

a like Membrane did joyn the two last Lobes. The right part of the Liver had but three Lobes. The first and greatest was the highest. The second was under it; 'twas by this Lobe that the left part of the Liver was joyned to the right, by the means of the *Isthmus*. The third Lobe, which was the least, issued out from the middle of the Cavity of the great Lobe, and did cover over the *Vesicula* which was fastned in this place, being inclosed in a *Sinus* or Cavity, which hindred it from rising without the Liver, as it usually does. It contained an Inch and half in length, to half an Inch in breadth. Its Figure resembling that of the *Vesicula* of a *Man*. The *Canalis Cysticus*, (which as in *Man*, was the continuation of the Neck of the *Vesicula*) was seven Inches long, and as big as a little writing Pen. It descended without having any Communication with the *Hepaticus*, and was inserted into the *Duodenum*, by a particular Aperture. The *Hepaticus* was double, as has been said. The right had several apparent Branches, which like Roots, were extended into the Lobes of the right part of the Liver. The left had none of the apparent Branches, but it formed a Trunk, which, immediatly issuing out of the Liver, didjoyn it self to the Trunk of the right *Hepatic*, joyn'tly to making but one Trunk, which went to insert it self into the *Duodenum* near the *Cystic*.

The *Vena Porta* had its Trunk in the right part of the Liver, between the the first and second Lobe. It shot forth a great Branch along the *Isthmus*, producing several Branches which were distributed into the left part of the Liver.

The *Vena Cava*, as has been said, had two Trunks, one right and the other left, which did penetrate the *Parenchyma* of the Liver, with which they were covered over near three Inches in length.

The *Spleen* was between the *Duodenum* and the *Colon*. It had the Figure of a Kidney, and received its Vessels by a depression like that which the Kidney has for the receiving its own. The Arteries did come from the Branch which distributes it self to the Liver and *Duodenum*. The Veins were Branches of the *Mesenterick*.

The *Pancreas* straitly embraced the *Duodenum*. It was likewise fastned to the Spleen, which it partly covered. It had the Figure of a Triangular Prism. Its *Ductus* was opened into the *Duodenum*.

The *Kidneys* were four Inches long, and three broad, in the form of a Triangular Prism, of a brisk red, divided into three or four pieces joyned together by their Vessels, and enclosed by the exterior Membrane. The emulgent Veins proceeded only from the right *Vena Cava*, which was quite taken up in two great Branches, the shortest whereof, which exceeded not an Inch, did enter into the right Kidney. The longest which had three Inches, passed on to the left; their entrance was towards the lower part of the Kidney. The *Ureters* issued from the superiour part, and run along the whole Surface, to which they were fastned as in Birds: There was a glandulous Body an Inch long, six Lines broad, and very thin, which was strongly connected to each of the Emulgent Veins. 'Twas in appearance a *Glandula Renalis*.

The *Testicles* were layd upon the Reins. They were two Inches and a half in length, and ten Lines in breadth. The *Epididymis* was of a particular Structure: 'Twas a *Ductus* folded into so many Circumvolutions, that being

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ing unfolded, it contained fourteen Inches, whereas before it had but four; This *Ductus* did not seem to proceed from the *Testicle*, but only from the Kidney to which it was fastned. Having made an Injection of a coloured Liquor into this *Ductus*, a great many other little *Ductus*'s were made to rise, which did not appear before, and which went from the *Testicle* to the *Epididymis*: These *Ductus*'s being enclosed in the Membrane which retained the Circumvolutions of the *Epididymis*, and which fastned it to the *Testicle*.

The Bladder was of an extraordinary bigness. There was found in it above twelve pounds of clear lymphid Urine: *Aristotle* tells us that the *Sea-Tortoise* has the Bladder very large, and the *Land-Tortoise* very small. Nevertheless ours was a *Land-Tortoise*: And in the Dissection which we have made of several *Water-Tortoises*, we have always found their Bladder a great deal less in proportion than that which we do Treat of. This makes us to think that there is an Error in the Text of *Aristotle*, by the transposition of the words *Terrestrial* and *Marine*; seeing that the Reason which *Aristotle* alledges for the greatness of the Bladder of *Tortoises*, does not well conclude to make us clearly understand that the *Terrestrial* ought to have it less than the others. For he says, that *Tortoises* not being covered with a Skin, whose Pores can assist in that Transpiration, which in other Animals consumes a part of the Moisture of the Body, and greatly diminishes the matter of the Urine; this Animal must necessarily have a great Receptacle for these Moistures, which the thickness and hardness of the Shell retains and includes; But he say's not that the Shell of *Sea-Tortoises* is thicker than that of the Land, nor that they do drink more: And according to *Aristotle*'s Reasoning, Fishes which are known to have no Bladder, ought to have one very large.

The Figure of the Bladder of our *Tortoise* was altogether as extraordinary as its greatness. It was made in the shape of a Gutt, and its Neck was not at one of the ends, but at the middle; which does indifferently well represent the *Membrana Alantoides* of the *Fetus* of most Brutes. This Figure is very different from the Figure of the Chestnut which *Severinus* gives it: It had two Foot in length. Its situation was Transverse, going from one of the Flanks to the other. Its Exteriour *Tunicle* was Membranous: The Interiour was strengthened by an infinite number of fleshy Fibres embossed, which were crossed and interlaced one within the other, imitating those which are seen on the inside of the Auricles of the Heart: These Fibres had their Origine towards the Neck, and dispersed themselves thro' the whole extent of the Bladder. The use of these Fibres is without doubt like that of the Fibres of the Auricles of the Heart, where they do serve to straiten and contract their Cavity, for pressing out what they contain. For the *Tortoise* not having like other Animals, a Belly flexible, and garnisht with Muscles which might compress the Bladder, this part ought to have in it self a particular Principal of Compression, by the means of which it might discharge it self of what it contains.

The Neck of the Bladder was an Inch in length and as much in breadth. It was fastned towards the middle of the *Rectum*, into which the Urine was discharged by a little Aperture or Oblique *Ductus* seven or eight Inches from the *Anus*. Within this Neck there was four little Teats, the two greatest of which were the Extremities of the *Vasa Spermatica Deferentia*: They were

about a Line in length. The two other lesser were the extremities of the *Ureters*.

The *Penis* which was enclosed in the *Rectum* as in a Case, as has been sayd, contained nine Inches in length, and an Inch and half over. It was composed of two round Ligaments, of a spongius Substance, and covered over with a fine Membrane. They were layd one against the other, and knitt together, not only by their Extremities, viz. near the *Glans*, and towards the root, which was at the Internal and lower part of the *Os Pubis*; but likewise by their Superiour part, for all their length, by the means of the Membrane of the *Rectum*, which was firmly fastned to them in this place, without adhering to them in other places, as by the sides and lower part. This Membrane was extraordinary strong at the place where it was joyned, containing near two Lines in thickness. The rest was thinner and of a blackish Colour: These Ligaments thus connected, did leave underneath a Cavity in the form of a Gutter, like to that where the *Urethra* is generally plac'd in other Animals. But in this which had no *Urethra*, this part was supplied by a Cavity, which the Ligaments themselves did form with the Tunicle of the *Rectum* only, at the time of the Evacuations which ought to be made by this *Ductus*. This did certainly happen by the swelling of the Ligaments, which being constringed by the Tunicle of the *Rectum* which embrac'd them, left a vacuity in the form of a *Ductus*, between the Tunicle of the *Intestine* and the Ligaments: For these Ligaments, tho' constringed, did not cease to keep something of their roundness, by reason of their swelling: And this made a triangular Cavity, the two sides of which, formed by the sides of the Ligaments, were Convex, and the third formed by the Tunicle of the *Intestine*, was strait. Each of the two Ligaments was not only Spongius, as it is ordinarily in other Animals, but they were hollow with a long Cavity in form of a Pipe, which went from the *Os Pubis*, where was the Origine of the Ligaments, as far as the *Glans*. The Vessels which were sent into the body of the *Penis*, had a particular distribution: For whereas the Artery, Vein, and Nerve, do usually all three run upon the *Penis*, there were but two in our Subject: And the Vein, after having formed a Net work, and several Circumvolutions towards the root of the *Penis*, did penetrate into the Ligament, and producing a Trunk, which running along the Internal and Superiour part of the Cavity, sent forth several Branches, into all the rest of the internal Surface of this Cavity. The Structure of the *Glans* was yet more Extraordinary than all the rest. Above it terminated in a point, and appeared to be the continuation of the Ligaments, not differing therefrom, neither in its Substance nor its Tunicle. Underneath it had two flat and almost circular Appendices, placed one upon the other. The greatest, which was fastned to the *Glans* underneath, was an Inch and half in diameter: The least, which was fix'd to the middle of the greatest, contained but half an Inch. It had moreover two little Appendices, like two buds about the bigness of a Line: All the *Glans* was of a Colour like to that of the Inferiour part of the Tunicle of the *Rectum*, which serv'd as a Case to the *Penis*; 'twas of a very dark slate Colour: There were two Muscles serving to draw the *Glans* inwards. They took their Origine from the *Vertebra Lumbares*, and passing along the side of the *Rectum*, inserted themselves at the upper part of the *Penis*, near the *Glans*.

To

Towards the middle, they were interlaced with two other Muscles, appointed for the Motion of the Tail, and which served them as a Pulley.

The Heart was seated in the upper part of the Breast, being closed in a very thick *Pericardium*, and fastned by the lower part of the Membrane which covered the Liver. Its Figure differed greatly from that which the Heart generally has. For instead of being extended from its *Basis* to its point, its greatest dimension was from one side to the other, being three Inches this way, and an Inch and a half only from the *Basis* to the point. The two Auricles which proceeded from the *Basis*, were very loose, and as it were hanging down: The right had two Inches and a half in length, to an Inch and half over: the left was lesser. The *Vena Cava*, which, as has been said, had two Trunks proceeding, the one from the right part of the Liver, and the other from the left, convey'd the Blood thro' each of these Trunks into each of the Auricles. These Auricles, as usually, opened each into a *Ventricle*, and at each of the Apertures which gave passage to the Blood from the Auricle into the *Ventricle*, there were three *Valvule Sigmoides*; which, contrary to what is usuall in this kind of *Valve*, hindered the Blood from going out of the Heart to return into the Auricles, performing the Office of the *Valvule Tricuspidis*.

Besides these two *Ventricles* which were in the hinder part of the heart which faceth the Spine, there was a third in the fore-part, inclining a little towards the right side. These three *Ventricles* were communicated by several Apertures, their Substance not being solid and continued as in the Hearts of other Animals, but Spongius and composed of Fibres and fleshy Columns, contiguous only to each other, and interwoven together. Besides the strait Apertures which were between these Columns, there were others more capacious, by which the two Posterious *Ventricles* had communication together, and with the Anterior *Ventricle*.

The two hinder *Ventricles*, as has been sayd, did receive the Blood from the two Trunks of the *Vena Cava* with the Blood of the *Pulmonique Veine*, which was double, there being one on each side: For these Veins emptying themselves into each Axillary, did mix the Blood that they had received from the Lungs with that of the *Vena Cava*, to carry it into the right *Ventricle*, from which the *Aorta* did proceed. The Anterior *Ventricle* had no other Vessel than the *Pulmonique Artery*: This Artery, as well as the *Aorta*, had three *Valvule Sigmoides*, the action of which was to hinder the Blood, which is got out of the Heart, from re-entring, when the *Ventricles* have dilated themselves to receive the Blood of the *Vena Cava* and the Lungs.

This uncommon Structure of the *Ventricles* and Vessels of the Heart must have some particular uses, on which we will not declare our Conjectures supported on different Experiments, till after having shewn that the Structure of the Lungs is not less extraordinary: For the one and the other Structure is thus extraordinary; in these parts, by reason of the particular Actions that they have in *Amphibious* Animals, of which kind the *Tortoise* is.

The *Aorta*, at the end of the right *Ventricle*, was divided into two Branches, which formed two Crosses. These Crosses, before they were quite turned downwards, did produce the *Axillares* and *Carotides*. Afterwards the left Cross descending along the *Vertebra*, did cast forth Branches: The first was distributed to all parts of the *Ventricle*. The second went to the Liver, *Pan-*

creas, *Duodenum*, and Spleen. The third furnished Branches to all the *Intestines*. Afterwards it was united with the Branch of the right Cross, which descended so far without casting forth any Branches, and both formed but one Trunk, which descending along the Body of the *Vertebra*, gave Branches to all the parts of the lower Belly.

The *Larynx* was composed, as in Birds, of an *Arytenoides* and *Cricoides*, articulated together. The two Bones, which do each make one of the Horns of the *Hyoides*, were not articulated the one to the other, but each separately in different places of the *Basis* of the *Hyoides*. The Cleft of the *Glottis* was strait and close, apparently to keep the Air a long time enclosed in the Lungs, for uses which shall be afterwards explained. It may be also believed, that this so exact inclosure is to prevent the Water from entering into the *Apera Arteria*, when the *Tortoises* are under Water: And this particular Conformation of the *Glottis* may be the Cause of the Snoring of the *Sea-Tortoises*, which as *Pliny* reports, is heard a great way when they do float sleeping upon the Surface of the Water. The *Sea-Calves*, which are likewise remarkable for their Snoring, have also their *Glottis* and *Epiglottis* extraordinary close, as has been remarked in the Description of this *Amphibious* Animal.

The *Apera Arteria*, which had its Rings intire, was separated at the entrance of the Breast into two long Branches of six Inches each. From the entrance of the Lungs these Branches did loose their Cartilages, and produced only Membranous Channels very large and unequal, containing even an Inch and half in some places, and half an Inch only in others. The Membrane that formed these Channels was transparent and thinn, but solid and fortified with Ligaments linck'd together after the manner of a Nett, composed of several Masles, like to those that are seen in the second *Ventricle* of Animals that ruminate. Each of these Masles, was the border and entrance of a little Pouch, which opened into a second, and that sometimes into a third. The Branches of the Veins and Arteries of the Lungs did run along the Ligaments, of which they did accompany all the Divisions, equally distributing the Blood into the whole extent of the Lungs. The Authors that have thought that the *Tortoise* has no Blood in the Lungs, have grounded this opinion on the whiteness and transparency of the Membranes whereof they are composed, which do make it to appear altogether Membranous when it is swelled; whereas that of other Animals appears fleshy: But the truth is, that the only difference is that of more and less: The Lungs of *Man*, after the same manner as that of other Animals, being composed of nothing else but small *Vesicles* heapt one against the other, amongst which the Sanguinary Vessels are interlaced in so great a number, that they do form an appearance of flesh, like little Lobes fastned to the Channels of the *Bronchi*; and 'tis of these little Lobes that the great Lobes of the Lungs are composed.

Yet this difference, of more and less fill'd with Blood, has seem'd to us to pass for essential, and sufficient to establish a *Species* of Lungs, which is one of three to which we reduce the Lungs of the Animals that we have dissected: For we have found Lungs which did appear absolutely fleshy, others absolutely Membranous, and others partly fleshy and partly Membranous. The Lungs of all four footed Terrestrial Animals, which lay no Eggs, and some

of

of the *Amphibious*, as the *Sea-Calf*, are of the first *Species*: And these Lungs do absolutely appear fleshy, because that the Blood is equally dispersed thro' all their Substance, into which it Circulates entirely, making all the Blood to pass thro' the Lungs by its Vessels from one *Ventricle* of the Heart to the other. The Lungs of *Tortoises*, *Serpents*, *Frogs*, *Salamanders*, *Camelions*, &c. are of the second *Species*; And they appear absolutely membranous, having but very little Blood dispersed into their Substance, *viz.* only that which is necessary for their particular Nourishment: So that there is no other Circulation made in its Vessels but of this Nourishment. The Lungs of Birds are of the third *Species*, and they do appear partly fleshy, and partly Membranous, by reason that the part which is fastned to the Ribbs is filled with a great quantity of Vessels, by which the Circulation is entirely made as in Terrestrial Animals: and the other part, which is divided into eight and sometimes into ten great Bladders, has no Vessels, and the Circulation therein is only for its peculiar Nourishment.

These three *Species* of the Lungs may be reduced to two, if their differences be taken from the use which the Lungs have, in relation to the entire Circulation of the Blood: And in this case the Lungs of *Tortoises*, and other *Amphibious* Animals of that kind, will make a particular *Species*, their Lungs being uselefs for the entire Circulation. And the Lungs of Birds, and that of Terrestrial Animals will make another *Species*, which will be common to those whose Lungs appear absolutely fleshy, and those that appear only in one part. For the establishing these two *Species*, there may be likewise added another difference taken from the Motion of the Lungs, which in Terrestrial Animals, even as in Birds, is continual, regular, and periodical: And in the others, as in the *Tortoise*, *Camelion* &c. it is interrupted, and so seldom and unequal, that the *Camelion* is sometimes half a day without ones being able to discern in him any Motion for the Respiration: And sometimes it is perceived to swell on a sudden, and to remain a quarter of an hour in this condition. The *Tortoise* does probably use the same manner. We have a long time observed several living and entire, and we have taken notice that indeed they sometimes cast forth a cold Breath thro the Nostrils, but it is by intervals, and without order. In those which were opened alive, we saw that the Lungs remained continually swelled by the exact compression of the *Glottis*, and that it shrunk entirely and suddenly, when entrance was given to the Air by cutting the *Aspera Arteria*.

When the Breast of a living Dog is opened, by taking away the *Sternum* with the Cartilaginous Appendices of the Ribbs, the Lungs are observed suddenly to sink, and afterwards the Circulation of the Blood and Motion of the Heart to cease in a little time, after that the right *Ventricle* of the Heart, and its Auricle with the *Vena Cava* are swelled, as if they were ready to burst: So that to prevent the Animals Death, the end of a pair of Bellows is put into the *Aspera Arteria*, and pushing in the Air to make the Lungs swell, and afterwards withdrawing them to make them sink, they are Artificially made to have the Motion that they Naturally use: and it is observed that the *Ventricle* and right Auricle of the Heart with the *Vena Cava* do unswell, and the Heart resumes its ordinary Motion again.

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This hapnes not to the *Tortoise* in which one has laid open the Lungs; for whether they continue swelled, or whether they do shrink, the Circulation and Motion of the Heart do continue so well in their Natural manner, that it was experimented that a *Tortoise* has lived above four days in this Condition. We have also made another Experiment to know more distinctly the Necessity of the Motion of the Lungs, for the entire Circulation of the Blood in Animals whose Lungs are absolutely Flethy, and which are not *Amphibious*. An Injection being made by the right *Ventricle* of the Heart into the Artery of the Lungs of a dead *Dog*; it happens that if one continues to make the Lungs rise and sink by the means of Bellows put into the *Aspera Arteria*, the Liquor which is pushed into the Lungs does easily pass, and go thro' the Vein into the left *Ventricle*: And that when one ceases to blow, it passes not but with a great deal of difficulty.

After having veiwed the different Structure of the *Ventricles*, and Vessels of the Heart of the *Dog* and *Tortoise*, it is easy to give some probable Reasons of the *Phænomena* of these Experiments: for it may be said that the Lungs of the *Dog* being sunk after Expiration, the Vessels are compressed after such a manner, that the Blood cannot pass; and that it is necessary that these Vessels are dilated by Inspiration for the receiving the Blood of the right *Ventricle* of the Heart; and that they be afterwards compressed in the Expiration to press it out, and make it pass into the left *Ventricle*. It may be again Imagined that the *Ventricles* of the Heart of the *Tortoise*, and other Animals whose Lungs are absolutely Membranous, not having their walls solid like those of the Heart of the *Dogg*, (wherein the Blood has no freer passage from one *Ventricle* to the other, but cross the Lungs) but that being Porous in all their Substance, and also open one into the other by very large holes, it must not be thought strange, that altho the Lungs remain Immoveable, whether blown up, or sunk, the Circulation is not hindered, and that in these Animals it is always performed after the same manner as it is in the *Fœtus*: Because that in the *Fœtus*, as in these Animals, the Lungs receive the Blood only for their Nourishment, and not for the intire Circulation, so that it sends to the Heart only the remainder of what it has not consumed: And in fine as the intire Circulation is not performed but by the *Anastomoses* of the Heart in the *Fœtus*; it is done also in the other Animals which we treat of, only by particular Apertures which the *Ventricles* of their Heart have one into the other.

But to be more assured that the Blood Circulates not intirely thro' the Lungs in the *Tortoise*, the Trunk of the Artery of the Lungs was tyed up: and it was observed that the Motion of the Heart was in no manner altered, and that the Circulation was continued always after the same manner. Now this is easier to be seen in this Animal than in others, by reason that its Heart being whitish, and the Walls of the *Ventricles* thin before, the Blood was in some sort seen to enter in and go out of the right *Ventricle*, from which the *Aorta* proceeds, as has been declared; and this was known by a redness which happens when the point of the Heart approaches its *Basis*, and which disappears when it is remote from it. For it is easy to judg that when the point approaches the *Basis*, 'tis then that the Heart utter'd the Blood from its *Ventricles*, because that at this very instant their Walls pressing inwards,

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and compressing the Blood did cause a redness to appear in this place. The Compression being capable of making the Bodys, which their Spongyous consistence has rendered Opaque to become diaphanous by the diminution of the Intervals, which make them Spongyous: In fine, this Circulation thus apparent, & which has continued for four Dayes, the Lungs being opned and cut in several places, has seem'd to us very clearly to Demonstrate that in the *Tortoise* the Lungs serve not for the Circulation of the Blood, as in the Animals which have fleshy Lungs.

The true use of the Lungs in the *Tortoise* and other Animals of its *Genus*, is a thing which has seem'd to us obscure enough to excite us to examine it carefully, and to allow us the boldness of promoting thoughts somewhat extraordinary, following the liberty that we thought we might take to our selves in these *Memoires*, where we do not place things as being compleated, but only as materials which may be employed or rejected, according as they shall be found fitt, or useles or defective, when time by new Experiments or better Argumentations shall better make known their Worth.

We do believe then that there is no appearance that the Lungs of the *Tortoise* serve for the intire Circulation of the Blood, for the Reasons which have been alledged: neither is it made for the Voice, the *Tortoise* being absolutely Mute. And it is not conducing to the refreshment of the Internal Parts, nor for the Evacuation of their Vapours, seeing that it wants the continual and regulated Motion which is observed in other Animals, and which is necessary for these purposes. So that there remains only the compression of the Internal Parts, whose uses have been explained in the Descriptions that we have made of Birds; and which are reduced to the preparation and distribution of the Nourishment: But we do search after another use more Important, and which being more particular to the *Tortoise* and the other Animals of its *Species*, does better answer to the particular Conformation of their Lungs; and we have found that to this part may be attributed the faculty that the *Tortoise* has of raising, and holding it self above the Water, and of sinking to the bottom when it pleases, in so much that it supplies the place of the Air-Bladder, which is found in most *Fishes*.

There are several conjectures on which we found the probability of this Opinion, and which do make us to think that this Bladder of *Fishes*, and the Lungs of the *Tortoise* being enlarged, do render the Body of these Animals light enough to Swim upon the Water; and that when these parts are contracted, and the Air which is capable of compression, taking up less room by reason it is straitned, and so the whole Body being less extended, it descends to the bottom, after the same manner as the little hollow Figures of Enamel enclosed in a Pipe of Glass, do sink to the bottom when by pressing on the surface of the Water, the Air is compressed which is enclosed in the Cavity that makes them Swim.

We have frequently observed that as soon as a *Tortoise* is put into the Water, it casts forth thro' the Mouth or Nostrils, several bubbles, which are in all likelihood formed by the overmuch Air that it has in its Lungs, for the keeping it self in a just *Equilibrium*, which puts it in a condition of being heavy enough to sink to the bottom, at the least compression which its Muscles do make upon its Lungs, just as the little Figure of Enamel descends in the Water

Water, at the smallest effort that is made to compress the Air that it encloses; and it is easy to comprehend that if the *Tortoise* being at the bottom of the Water, relaxes the Muscles that did compress its Lungs, the Air by the Virtue of its Spring returning into its first State, can give again to its whole Body, the extent which it had when it did Swim upon the Water.

The probability of this Arguing has been confirmed by Experience. A living *Tortoise* was lockt up in a Vessel full of Water, on which there was with Wax exactly fastned a cover, from the top of which there went a Glass Pipe. The Vessel being full so as to make the Water appear at the bottom of the Glass pipe, we observed the Water did sometimes ascend into the Pipe, and that sometimes it descended. Now this could be done only by the augmentation and diminution of the Bulk of the *Tortoise*; and it is probable that when the *Tortoise* endeavoured to sink to the bottom, the Water fell in the Pipe, because that the Animal lessened its Bulk by the contraction of its Muscles; and that the Water rose by the slackning of the Muscles, which ceasing to compress the Lungs, did permit it to return to its first size, and did render the whole Body of the *Tortoise* lighter.

The exactness with which the *Glottis* is closed in this Animal, seems greatly to assist the effect of this compression; even as it is credible that it is for such an use that the Bladders of Fishes are so closed, that what force soever be used for the Compressing them, the Air cannot be got out otherwise than by bursting them: For there is no likelihood that these Bladders are in Fishes to remain always in one State: They would hurt them as much in hindering them from descending in the Water, as they would assist them by making them to rise towards its Surface, and for this purpose it would have sufficed that their body was of a Substance thin enough to render their bulk proportioned to their weight, such as is the Substance of Wood and other Spongy Bodies which do Swim upon the Water. We have for a long time observed *Tortoises* floating upon the Water without stirring. Fishes do likewise keep themselves a long while in one place under Water, sometimes near the bottom of the Water, sometimes near its Surface. The little Figures of Enamel do thus stop themselves in different places according to the different Compressions that are made in the Air which they do contain.

Aristotle and *Pliny* have remarkt that when *Tortoises* have been a long time upon the Water during a Calm, it happens that their shell being dried in the Sun, they are easily taken by the Fishermen, by reason that they cannot plunge into the Water nimbly enough, being become too light. This shews what equality there ought to be in their *Equilibrium*, seeing that so little a change as this; which may happen by the sole drying of the Shell, is capable of making it useles. For it is probable that the *Tortoise*, which is always careful to keep it self in this *Equilibrium*, so as other Animals are to keep themselves on their Leggs, in this case, by the same instinct, dares not let the Air out of its Lungs, to acquire a weight which might make it speedily to sink; because it fears that its Shell being wet, it should become so heavy, that it being sunk to the bottom of the Water it might never have power afterwards to re-ascend.

Now the Observation of the unmoveableness of the Lungs, does very well agree with the want of the Organs, which might serve for its Motion; for the

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the *Tortoise* has not only its Shell, which supplies the place of the *Sternum*, absolutely immoveable, but in it we have found neither *Diaphragme*, nor other parts which might supply this Motion. The Bone of the Arm called *Humerus*, which it has enclosed in the Breast, has a very long *Apophysis* at the place of the Articulation of the *Cubitus*, which is joyned with another Bone articulated to the *Cubitus*: So that these Bones do jointly form two productions on each side, which approaching forward, are like *Clavicule*: But these parts are immoveable, and do evidently serve only for a *Basis* or Origine to the Muscles which do supply the place of Pectorals; and which draw forward the moveable part of the Arm, viz. the *Cubitus*, *Radius*, and Hand. There were found Muscles enough that might serve for the Compression of the Lungs; but Muscles alone are not proper to its dilatation; there must be the Ribbs and a *Sternum*, or something *Analogus* that may be moveable. So that it is apparently necessary to suppose that the Inspiration is made by the Spring of the hard and firm Ligaments which compose the Masthes that have been described: Inasmuch that when the Muscles which may compress the Lungs begin to slacken, these Ligaments are extended, and enlarging the Apertures of all the Bladders, do encrease the capacity of the whole Lungs. Altho' our *Tortoise* was not of those that live in the Water, it did not fail, in regard to this particular formation of the Heart and Lungs, to have it like that of the Animals of its *Species*, as several Birds are observed to have Wings tho' they do not fly.

The *Brain* was very small: For the size of the Head, which, in proportion to the rest of the Body, is very small, consisted principally in the Bones of the *Cranium*, and in the Flesh of the *Crotaphita* Muscles that covered it, and which were thick as in the *Lyon*: The Bone of the Crown of the Head having a crest after the manner of all Animals that have an extraordinary strength in the Jaws. The *Cerebrum* with the *Cerebellum* were in all sixteen Lines long and nine Lines broad. The *Sea-Tortoises* which are taken at the *Antilles* have it three times lesser in proportion: For, according to the Relations which we have of those Countries, the *Tortoises* which have there a Head as bigg as that of a *Calf*, have the Brain no bigger than a Bean.

The Membranes of these two parts, their Substance, the *Lacis Choroides*, the *Glandula Pinealis*, the *Pituitarius*, the *Infundibulum*, and generality of the Nerves were after the same manner as they are seen in Birds: The other parts had something particular. The *Olfactory* Nerves were of an extraordinary grandure, making near the fourth part of the whole Brain. The *Optick Nerves* took their Origine from the *Olfactory*. The two *Tuberosities* that the *Cerebellum* has in Birds, instead of being fastned to the lateral parts of the *Medulla Spinalis*, were in its upper part. The *Cerebellum* was neither furrowed by parallel Lines on the out side, nor diversified on the inside by the different Colours of its Substance, which represent the Branches of Trees, and its Cavity was advanced very farr into the *Medulla Spinalis*, going even to the first *Vertebra* of the Neck.

The *Medulla Spinalis* was covered with its vsual Membranes and moistned by several Vessels which did accompany it to its End; It filled the whole Cavity of the *Vertebra* and sent from one part and the other several pair of Nerves; Those which were distributed to the Arms, leggs, Neck, and Tail, were very large and Numerous.

The *Globe* of the *Eye* was an Inch Diameter. The Internal Eye-lidd which we have seen stirr in living *Tortoises*, had the same Muscles which we have observed in Birds. The *Cornea* was very thinn. The Aqueous Humour had a Consistence so thick, that it did hardly run: The *Iris* was of a light-foot-Colour; There were seen several Vessells interlaced. In the little *Tortoises* that we have here, which are all water *Tortoises*, the *Iris* had four yellow rayes on a ground of light foot-Colour. These rayes were disposed in Crosses round the hole of the *Uvea*. The *Chrystallinus* contain'd but one line Diameter. It was flat and lenticular. The Membrane made like a black purse which is found in the Eyes of Birds, was not met with in our Subject. The *Tongue*, whose Figure was Pyramidal, had an Inch in length and four lines in Breadth. It was thinn, not exceeding a line, the fleshy substance of which made but the half. The *Tunicle* had over it a great number of little Teats. The *Tongue* with the *Os Hyoides* had Ten Muscles, five on each side. The first, which drew the *Os Hyoides* forward, went from the *Symphysis* of the lower Jaw to the Basis of the *Os Hyoides*: The second, which drew it side ways, went from the Interiour part of the *Omo-plas* to the Basis of the *Hyoides*: The third which drew it upwards, went from one of its Hornes to its Basis. The fourth which drew the *Tongue* forward, went from the *Symphysis* of the Chin to the side of the *Tongue*. The Fifth, which drew the *Tongue* sideways and towards the Basis, went from one of the Hornes of the *Os Hyoides* to the Basis of the *Tongue*.

The Necessity that there was of keeping the Remains of this rare and extraordinary subject, for an Ornament of the *Aviary of Versailles*, having hinder'd us from pursuing any farther the Enquiry of the Organs of sense in the Head of our *Tortoise*, we have supplied this defect by the dissection of several other *Tortoises*, where we have observed that the Olfactory Nerves terminated at a delicate Membrane of a black-Colour, which covers the Inside of the nostrills; This Membrane had neither folds nor Ridges that did enter into the holes of the *Os Ethmoides*: In the Anterior part of the palate, there was two holes which opened into the Nostrills.

As to the *Ears*, in our small *Tortoises* as well as the great, there was no External Aperture, the Bone did appear only sunk at the right side of the Temples; And the skin covering this Sinking was thinner and more delicate than elsewhere, and seemed also some what sunk in this place. After having taken away this skin, there was discovered a round hole of the bigness and forme of that of the hole of the Eye. It was closed by a kind of *Cartilaginous* thin plate very moveable, being fastned all about to the edge of the round hole by a very thin Membrane. At the side of the hole towards the hinder part of the head, there was a *Cartilaginous Ductus*, which descended into the palat, where it had a long Aperture making a little cleft. Under the *Cartilaginous* plate there was found a great Cavity of an Oval figure, very long, containing twice its breadth. This Cavity was pierced at the side, to give passage to a little *Stiletto* very small, which came obliquely to sustain the *Platina* by one End, and by the other, having passed thro a second Cavity, which was a little beneath and beside the great one, it stopped a hole by which the second Cavity was opened into a third, which was Anfractuons, and which received the Auditory Nerve; The End of the *Stiletto* which closed the

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the Aperture of this third Cavities went enlarging it self like the end of a Trumpet, and had a delicate membrane which fastned it to the Circumference of the hole.

Those who have made the Description of the *Ant-Isles*, which of all in the world has the greatest quantity of *Tortoises*, do say that they are deaf. We have reason to doubt, considering the Organs that we have just described, whether these Historians may have used all the care necessary for the being well instructed in this Particular, it being probable that they contented themselves with the conjecture which may be drawn thereupon from the defect of the Aperture which these Animals have in their Ears: Unless the Ears should be in *Tortoises* the same as the Eyes are in *Moles*; that is to say they should have Ears without Hearing, as the *Moles* have Eyes with which they do not See.

The Observation which we have made upon the *Tortoise's* stirring its Neck to turn itself when it is on its back, has given us an opportunity of searching out the Muscles which do bend and extend this part. We have first found that this Neck has two kinds of Motion, which are each composed of flexion and extension. The first Motion is that by which the *Tortoise* draws its Neck and Head inwards, or extends it, and makes it to go outwards. The second is that by which the Neck being thrust out and extended, is turned on all Sides. In the first kind of motion the Neck is extended when the Muscles which serve for the different flexions of the Neck do act together and with an Equal force; And it is drawn in with the head by two different flexions and Extensions of the *Vertebra*, one of which is at Top and the other at bottom: which gives to the Neck a figure like to that which the Neck of a *Swan* takes when this bird draws its head towards its back. For this reason, besides the Muscles which do turn the Neck every way when thrust forth, and which are common to all the motions of the Neck, there are five particular ones on each side which springing from the *Apophysis lumbaris* and from the last ribs, do ascend along the *Vertebra* of the back, and are inserted in five different places of the oblique *Apophysis* of the *Vertebra* of the Neck, the longest being fastned near the Head to the body of the first *Vertebra*. The Muscles which, when they act separately do serve for the flexions of the Neck thrust outward, do spring from the *Vertebra* of the Neck, and are likewise inserted to its *Vertebra*. Some taking their Original at the body of a *Vertebra*, are inserted to the *Apophyses* of others: Others proceeding from the *Apophyses* are joyned to other *Apophyses*; Inasmuch that when the Muscles of one side do act Separately, the flexion is made on that very side; and when they do act jointly with an Equall force, the Extension of the whole Neck Ensues, as has been said.

When the Head is drawn inward, it sinks into a fold of the Skin which is upon the shoulders, which forms as it were a Hood. This is done by the means of a very large and thick Muscle adhering to the Skin, and which being fastned to the *Spinal Apophyses* of the *Vertebra*, from whence it seems to rise, is folded underneath, covering and enveloping the *Aspera Arteria* and the *Osophagus*. The Different Situations of the *Fibres* of this Muscle, which may make it to passe for an union of several Muscles, do produce the divers folds of this Skin made in form of a Hood, when they do act differently.

ALPHABETICAL TABLE

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<i>Goat.</i>	

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Goat

Halibut

Hedge

Heriff

Hen

Guinea

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Hinder

Hyena

Hystri

Kema

Laman

Lion.

Lionn

Lupus

Lynx.

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FINIS.

THE MEASURE OF THE EARTH.

ARTICLE I.

THE attempt to determine the Magnitude of the Earth is not new. Many ancient Authors have made themselves famous by this enquiry. But the most memorable Attempt for this purpose was that of the *Arabians*, thus Recorded by their Geographer. A great Circle on the Earth is divided into 360 parts, as we also suppose those in the Heavens. *Ptolomy* Author of the *Almagest*, and many other of the Ancients have observed what space upon the Earth contains one of these 360 Parts or Degrees, and have found it to contain 66½ Miles. Those which succeeded them, willing to satisfy themselves by their own experience, met by the order of *Almamoon* in the Plains of *Sanjar*, and having taken the height of the Pole, they divided into two Troops, the one marching as directly as was possible towards the North, and the other towards the South, till the one found the Pole one Degree more, and the other one Degree less elevated; then meeting again at their first station to compare their Observations, they found the one had computed 56½ Miles, but the other just 56. but they agreed to account 56½ for one Degree, so that between the Observations of the Ancients, and of these Moderns there is a difference of 10 Miles.

Abulfeda
in his Prei
face.

Now *Ptolomy* having establish'd the bigness of a Degree 500 Stadia, for which the *Arabs* account 66½ Miles, it follows that the Arabian Mile was equal to 7½ Stadia; but we are to seek what Stadium *Ptolomy* means; for if it were the Greek, eight of which made one ancient Italian Mile, the proportion of the Arabick Mile, so the Italian will be as 15 to 16, and consequently the 56½ Miles found in a Degree by the *Arabs*, will make but 53½ old Italian Miles. But if more favourably to the *Arabs*, we suppose (which

is most likely) that the 500 Stadia of *Ptolomy* were the Alexandrian, bigger than the Grecian, according to the proportion commonly received of 144 to 125, we shall find that the Degree measured by the *Arabs* was 61 Italian Miles, which makes 47188 Toyses of *Paris*, supposing that the old Roman Foot (the same which Father *Ricciolus* after *Vilalpandus* would have established it) was to that of *Paris* as 667 to 720. though the Roman Foot, of which the Module is to be seen in the Capitol, is to the same Parisian Foot, but as 653 to 720. or thereabouts.

'Tis very remarkable that anciently the measure of the Earth was always upon the diminishing. For if we will believe *Aristotle*, or the most part of the *Mathematicians* of his time, according to his report, a Degree was about 1111 Stadia, whereas *Eratoſthenes* counted but 700. *Poſſidonius* 666, and in fine *Ptolomy* 500. In like manner the *Arabs* following the same example make a Degree less than all that preceded them. But without entering upon the determination, whether these Opinions are so different as they appear, it may suffice in brief to say that we are ignorant of the just quantities of the ancient Measures, all the Measures that the Ancients have left us being altered by time.

Amongst the Moderns, *Fernelius* and *Snellius* are the chief, who not contenting themselves with uncertain Traditions, were willing to leave us their particular Observations for the bigness of a Degree.

Fernelius at the beginning of his *Cosmotheoria* says, that leaving *Paris* he went directly North, until by the Meridian Altitudes of the Sun he found the height of the Pole one whole Degree more than at *Paris*. But whether because he would imitate the *Arabs*, or for some other Reason he has concealed the name of the place where he staged, saying only that it was at 25 Leagues from *Paris*, and that for knowing this distance more precisely he went in a Coach, and counted all the turns of the Wheel till he arrived at *Paris*. And in fine, having estimated how much the irregularities and turnings of the way might augment the length, he judged that a Degree of a great Circle of the Earth contained 68096 Geometrical Paces, which according to our way of measure are equal to 56746 Toyses and four Feet of *Paris*.

Snellius took a more certain way, and somewhat like what will be found practiced in the following account; for instead of relating his estimation, he searched by Geometrical ways the Meridional Distances between the parallels of *Almain*, *Leyden*, and *Bergopson*, then according to the differences of the heights of the Pole in those Places, he concluded a Degree was 28500 Rhinland Perches, which make 55021 Toyses of *Paris*.

This last Measure was commonly followed as the most exact. But Father *Riccioli* by a method which we shall anon examine, hath (since highly prized above other) made the Degree 64363 Paces of *Bologna*, or about 62900 of our Toyses.

In

In this diversity of Opinions 'twas worth while to try the whole anew for the solution of this famous Problem, not only for the use of Geography in what concerns the difference of Longitudes, but more particularly for the use of Navigation. And that so much the rather, for that to this time not a Person has understood the prevalency of the great advantage that may be made of Telescopes from the executing of this Design, and for that by other means it is easie to establish a measure which cannot change.

ARTICLE II.

THE Earth and Water make but the same one Globe which comprises both the one and the other under the name of the Earth. We shall not stay to shew the proofs here, but this truth being suppos'd for constant, 'tis demanded what is the bigness of the Globe of the Earth; and since it would be impossible to measure the compass intire, 'tis reduced to the measure of one part, from whence the bigness of the whole may be concluded; which reduction is ordinarily to the quantity of one Degree.

For since the roundness of the Earth is a little varied by the inequality of the Mountains, like that of a very fine Orange by the grain of its Peel; these inequalities are so considerable to our purpose, and so great in comparison of common measures, that for the obtaining of the knowledge of a considerable distance, though less than that of a Degree, 'tis necessary to have recourse to Geometry, to make use of a Chain or succession of Triangles united together, the sides of which are as so many great measures, which passing over the inequalities of the surface of the Earth, give us the measure of a Distance, which it would be impossible to measure otherwise.

For the well forming of these Triangles 'twas necessary to point at far distant Objects with such preciseness, as not only to be sure of directing at the whole Object, but even at a certain point thereof. There has been invented for this divers sorts of sights, but all imperfect and incapable of giving the preciseness requisite. 'Twas on this account *Snellius* willing to excuse the error of some minutes which he found in his Triangles, had reason to blame his sights, through which (as he says himself) an Object of the bigness of some minutes appeared but as a point, and even so with difficulty. But for some Years it has been thought adviseable to put Telescopes in the place of the old way of Sights, which has been so happily performed that there seems to be nothing more to be desired for this purpose, as will appear by the sequel.

Erastosth.
Batavia,
pag. 169.

The Measure of the Earth.

ARTICLE III.

IN the design which was proposed for performing the mensuration of the Earth, it was judged that the space contained between *Sourdon* in *Piccardie*, and *Malvoisine* in the Confines of the *Gastinois*, and of the *Hurepois*, would be very proper for the execution of this design, because these two bounds which are distant one from the other about 32 Leagues, are situated very near in the same Meridian; and 'twas known by divers Journeys purposely made, that they might be joyned by Triangles, with the high-way from *Villejuive* to *Juvisy*; which way being paved in a strait line, without any considerable inequality, and of such a length (as will appear hereafter) was proper to serve for the fundamental Base of all the Measure that was undertaken.

For actually measuring the length of this way, four Pike Staves, each of two Toyses were made choice of, which being joyned two and two at the great ends by a Screw, made two Measures each of the length of four Toyses.

The manner observed in the measuring was, that after one of the Measures was placed on the Earth, the other was joyned to it end to end, along by a great Rope, then the first was taken up, and so successively. And for the more easy keeping the account, the Measurer who laid the second Rod had ten little stakes given him, one of which he left standing at the head of his Rod every time he laid it on the ground, so that every such stake noted eight Toyses; and when all the ten were taken up, they marked eighty Toyses.

In this manner the distance between the middle of the Mill of *Villejuive* all along the great or high way to the Pavillion of *Juvisy* was twice measured, which distance was found to be 5662 Toyses and four Foot in going, and 5663 and one Foot in returning. But as a nearer approach to exactness could not be hoped, so the difference was divided, and the round number of 5663 Toyses was agreed on for the length of the line, or fundamental Base upon the which we have built all the Calculations hereafter, save only that at the conclusion of our work we verif'd the whole by a second Base of 3902 Toyses actually measured as the former. In which without doubt we had very much the advantage of all those that have preceded us. For *Snellius* having begun by a distance measured of 326 Verges and 4 Foot of the Rhein Measure, which make 530 of our Toyses; It was afterward regulated by one which was not above 87 Rhein Verges, or 168 Toyses. And Father *Ricciolus* framed all his Measure upon a Base of 1088 Bologna Paces, or about 1064 Toyses of *Paris*.

ARTICLE IV.

THE Toyse of which we speak, and which we have chosen as the most certain Measure, and most used in *France*, is that of the Grand Chastelet of *Paris*, according to the original which has been lately re-establish'd. It is of six Foot, the Foot contains twelve Inches, and the Inch twelve Lines; but to prevent, that what has happen'd to all ancient Measures (of which nought but the names remain) might not happen to ours; we have adapted it to an Original taken from Nature it self, which ought therefore to be invariable and universal. To that effect the length of a single Pendulum was by two great Pendulum Clocks exactly determined, each of whose single vibrations or free agitations was one second of time conformable to the mean motion of the Sun, which length was found to be 36 Inches, 8 Lines and a half, according to the *aforsaid* measure of the Chastelet of *Paris*.

'Tis commonly known, that to make a simple Pendulum, a little ball about the bigness of a Musquet Bullet, is suspended by a very flexible thread, and the length of this Pendulum must be measured from the top of the thread to the center of the Ball, supposing the Diameter of the Ball not much to exceed the 36th part of the length of the thread, otherwise there must be an account had of a proportional part which We have here neglected; and care must also be taken that the vibrations be short, for if they be beyond a certain Degree, they are of unequal duration one to another.

The Ball of our Pendulum was of Copper of an inch in Diameter, and it was turned. The thread with which the first experiments were made was of flat or raw silk. But because that stretches sensibly by the least humidity of the air, it was found that 'twas better to use a single filament of a sort of long Flax called *Pite*, which is brought out of *America*. The upper end of the thread was put between a small Vice with a square head, which held it fast screwed most exactly; by this means the motion of the Pendulum was more free, and the length more easily measured by an Iron Rod exactly fitted between the end of the Vice and the Ball.

The two Clocks made use of were of the greater sort, whose Pendulums measured whole seconds, they were exactly regulated according to the mean motion of the Sun, and went slower by 3 Minutes 56 seconds at every return of the same fixt Star to the Meridian, with such a regularity that sometimes they differed not one from another by one second during many Days. A single Pendulum was set in motion, and made to go and come from the same side as the Pendulums of the Clock did, and being left in this condition they were inspected from time to time to see how they went. For how little soever the length of this single Pendulum either exceeded or wanted of 36 Inches, 8½ Lines, one might perceive some disagreement in less than an hour. 'Tis true that this length was

B *

not

not always found so precise, and that it seemed that it ought to have been regularly a little shortened in Winter and lengthened in Summer. But that however was but the 1000 part of a Line) so that having a respect to this variation, it has been judged best to take the mean between them, and to take the length of 36 Inches 8 Lines for the certain Measure.

If the length of the Pendulum for seconds be once found express according to the usual Measure of every place, by this means may be had the proportion of the different Measures so exact as if the originals had been compared, and this advantage would thence accrue, that for the future any change therein might be discovered.

But besides the particular Measures, an agreement might be found of such as follow, which will need no other original but the Heavens.

The length of a Pendulum of a second of the middle time might be called by the name of an Astronomical Ray, the third of which shall be the universal Foot. The double of the Astronomical Ray makes the universal Toise, which will be to that of *Paris* as 881 to 864.

Four times the Astronomical Ray may make the universal Perch equal to the length of a Pendule of two seconds.

Finally the universal Mile may contain 1000 Perches.

These universal Measures suppose that the difference of places causeth no sensible variation to the Pendulums. 'Tis true, there have been made some experiments at *London*, *Lyons* and *Bologna* in *Italy*, by which it seems one might conclude that the Pendulums ought to be shorter in some proportion as the *Æquinoctial* is approacht. Conformable to a conjecture which has been formerly proposed in the Assembly, that supposing the motion of the Earth, weights ought to descend with less power under the *Æquinoctial* than under the Poles. But we are not sufficiently informed of the justness of these Experiments to make any conclusion thence. And we must besides note, that at the *Hague*, where the height of the Pole is greater than at *London*, the length of a Pendulum exactly determined by means of Clocks, was found the same as at *Paris*. 'Tis for this we advise those who would make experiment with a single Pendulum, to make use of great Pendulum Clocks, for that otherwise they will difficultly meet with the just Measure. If it should be found by experience that the Pendulum will be of different lengths in different places, the supposition we have made concerning the universal Measure drawn from the Pendulums, cannot hold, but this hinders not but that in every place there will be a perpetual and invariable Measure.

The length of a *Parisian* Toise, and that of a Pendulum of seconds, such as we have now establisht, will be carefully preserved in the Magnificent Observatory, which His Majesty has caused to be built for the advancement of Astronomy.

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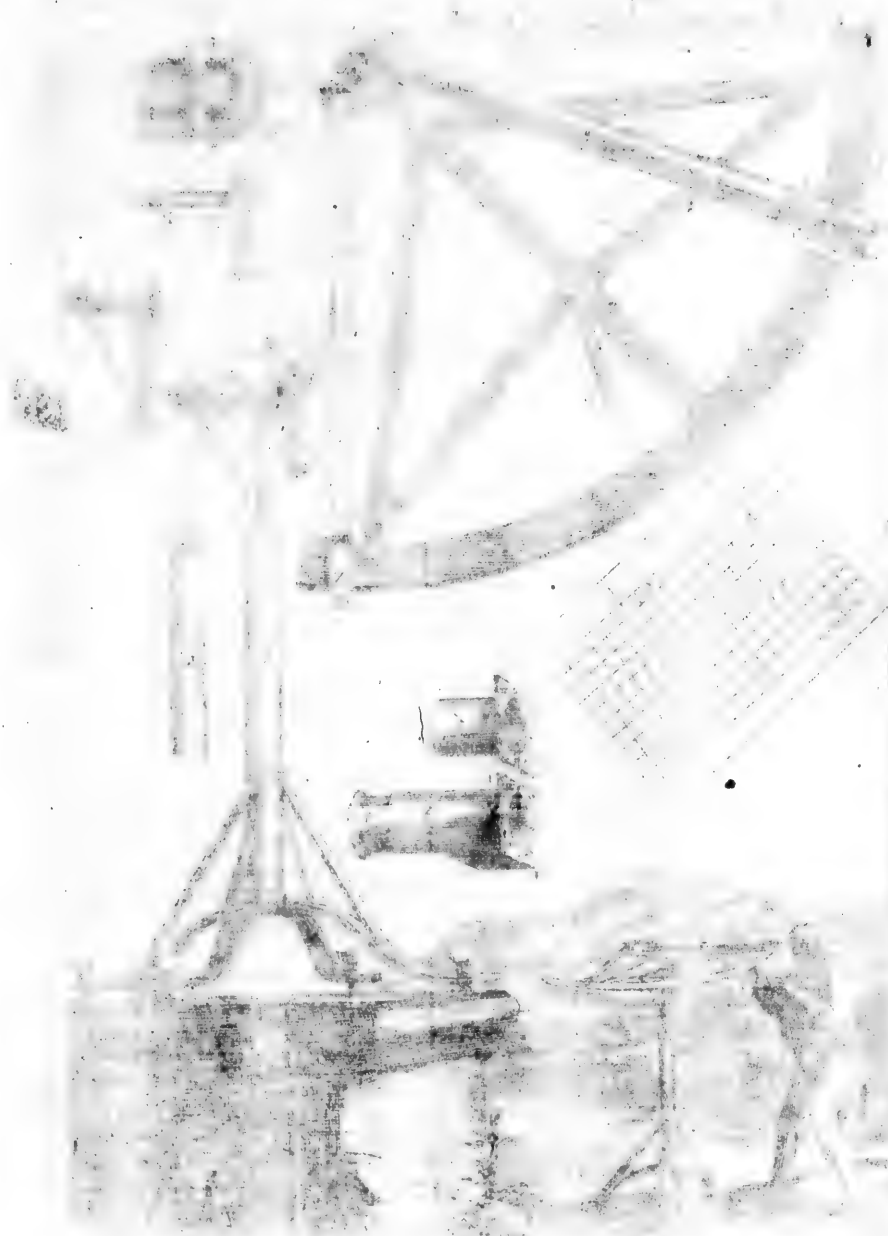
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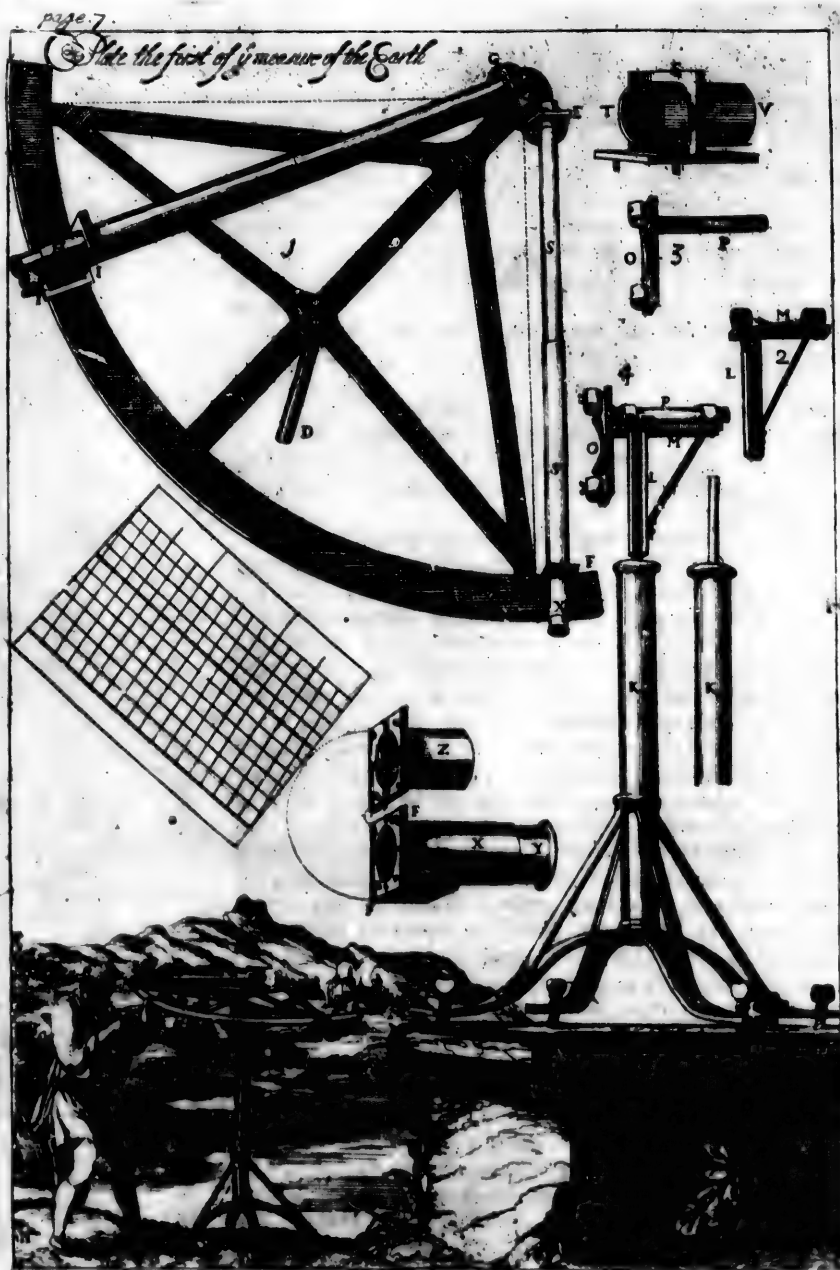
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ARTICLE V.

SINCE the Instrument we made use of for measuring the Earth, had somewhat singular, it will not be insignificant to describe it before we come to the following Observations.

This Instrument was a quarter of a Circle of 38 Inches Radius, the body of it is of Iron, and all the pieces are fastned together underneath by Screws upon the Area of it. The Limb B C and that part about the Center A, are covered with Copper. The Broach or Cylinder D is fastned perpendicular to the back of the Instrument to fix it on its Pedestal. EF is a Telescope which serves instead of the immovable sights, being fastned at one end to the Plate of the Center A, and at the other end to one of the extremities of the Limb.

GH is another Telescope carried by an Alidade or arm of Iron which turns upon the Center A, and which may be fixed upon any part of the Limb desired, according to the Angle to be observed.

The Limb BC is exactly divided even into Minutes very distinctly, much of the bigness and form represented in the adjoining Figure.

An Hair stretched in the little frame I, or a silver Wire smaller than a Hair, serves for the fiducial Line of the Alidade, by which one may very easily distinguish to the fourth part of a Minute, especially if a Loupe or Glass that magnifies the object, be used.

But that which we have here principally to describe, is the construction of the Telescopes EF and GH, which being in all things alike the one to the other, it will be sufficient to describe one of them.

SS is a Cylinder of Latton or Tin, made of two pieces running one within the other, that they may be taken off or put on at pleasure upon the two Pinnules EF which are fixed.

The Object Pinnule E carries in the fore-part of it marked T, an Object Glass of a Telescope of a length proportioned to the Instrument: And by the side V it sustains one of the ends of the Cylinder SS.

The eye Pinnule F is of three Pieces, the first FX which is fastned to the Limb of the Instrument is a hollow Cylinder about 3 Inches long, sodered to the middle of the (Chasse) or Frame FF, upon the face of which are two small single Clews of black Silk stiff strained at right Angles in four small graved strokes, which keeps them from breaking, and they are fastned by the means of a little melted Wax. The second Z is a little hollow Cylinder sodered to the former to the middle of a square Piece, which by two Screws is joined to the frame FF, to serve as well for the defence of the Filets, as to sustain the great hollow Cylinder SS. The third Y is another

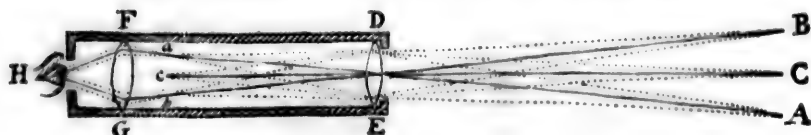
another little hollow Cylinder which is slipped within the first X, and which carries the Eye-Glass of the Telescope.

The fixed distance between the two Pinnules E F ought to be such that the anterior face of the frame FF, where the Fillets of the Telescope are strained, do meet each other exactly in the focus of the Object Glass; and this necessity causes the Object Glasses to be made (for the most part) first before the Instrument is begun. All put together does the effect of a Telescope that inverts the Object, which inconvenience may easily also be rectified, making use of more Eye-Glasses, and a little use will make it insensible.

All the
pieces of
such a Te-
lescope as

is here described, are yet more fully represented in the fourth Plate.

Beside the advantage that the common Telescopes give of being able better to distinguish a distant Object, they do also much facilitate the setting it true pointing to the Object with all the preciseness imaginable; for after one has through this Telescope taken notice of the far distant Object, one may at the same time see very distinctly the Threads (or Wires) that are in the Telescope, and also all that which the said Threads hinder to be seen of the Object, as if they were indeed stretched upon the very object it self, and the Eye upon removing perceives no Parallax at all between the one or the other, provided the Fillets or Threads, as we have said, be placed exactly in the focus of the Object Glass, because 'tis in this place that the painting of the Object is made reversed, which comes immediately to our Eye, and which is the place of the immediate Object, as may be easily understood by the following Figure.



ABC are three points of an Object, every of which fill the Object Glass DE of the Telescope FDEG with Rays; all these Rays having passed, traverse the Glass DE, they proceed to reunite by order in three other points a b c, namely, those of A in a, of B in b, and of C in c; then these same Rays are separated again, and proceed to fall upon the Eye-Glass, which in fine turns them towards the Eye H, the Rays of C are not continued to the Eye, to the end that it may appear what must happen when it meets with an obstacle in some part of the focus as in c, because it is evident that this obstacle hinders all the Rays of the point C, without permitting any one of them to arrive at the Eye, as if one had indeed covered the Object it self at the point C; but this Obstacle, such as it may be, a single filament of Silk, makes its distinct Image in the Eye precisely

precisely in the place where the Object which it hinders would have made its own Image, because the Eye is altogether disposed for receiving the Rays which are come from the focus a b c travers the Eye Glafs F G.

It is to be added hereto, that since all the Rays of the same point of the Object are reunited in another point of the focus of the Object Glafs, it happens here that notwithstanding all the aperture of the Object Glafs D E, one has the same exactness for pointing as if the Object Pinnul or sight were but one single, small, and almost indivisible hole through which the point C could traject but one Ray, which might be intercepted by the least obstacle placed in the Line Cc, because that which necessitates the placing the Threads in the focus is for that if they are placed either nearer to or farther from the Object Glafs, they cannot hinder all the Rays from the same point, which are not elsewhere united but only in the focus, and there will be some Parallax sensible if they be placed out of it, upon changing the position of the Eye, which however is most to be regarded when the aperture of the Object Glafs is large, for if it be but small, the place of the Threads does not require so very precise a distance from the Object Glafs, because at some distance on either side the focus, either nearer to or further from the Object Glafs, the Rays are not so far separated as to become sensible. And 'tis also in the straitning or lessening of the aperture of the Object Glafs that an inconvenience may be prevented, which happens to the Threads when being well placed for a remote Object, they are not so exact for Objects that are nearer.

There may remain one difficulty upon the account of the Object Glafs, if it be not of an equal thickness, thereby causing some refraction, and bending the principal Ray Cc from a straight Line. But notwithstanding all the defects of this Glafs, there is no reason to fear in respect of the Angles of position, or of the apparent distances which one would observe, because when the two Telescopes are directed to the same Object at a distance, the fiducial Line of the movable rule (or arm) falls exactly upon the beginning of the first Degree. And this is a proof with which we ought always to begin when one would take Angles. We shall give in the ninth Article the means of remedying defects and refractions of Glasses in regard of heights.

The Figures 2, 3, 4, represent the pieces which serve to set the Quadrant upon its Foot. The piece L M movable upon the Foot K, suffices to set this Instrument to its plumb or perpendicular, when one would observe heights, but for putting it horizontal, the second Piece O P must be added to L M, in the manner as is represented in the fourth Figure, and then one may give the Quadrant such position as one will, as with a Knee.

Thus you have the full description of the Instrument which gave the Angles of position with so much exactness, that upon the whole compals of the Horrifon taken at 5 or 6 Angles, there was not

found above a minute more or less than it ought to be, and which often also happened within about 5 seconds of the just account, so that it was not necessary to carry a bigger Instrument, of which it was otherways impossible to make use in several occurrences.

ARTICLE VI.

THE distance which was proposed to be measured from *Malvoisine* to *Sourdon*, is found as 'twere parted into three Lines, to wit, from *Malvoisine* to *Mareuil*, from *Mareuil* to *Clermont*, and from *Clermont* to *Sourdon*. These particular distances were known by the means of 13 Triangles, represented in the first Figure of the second Plate. There were two of them which needed no particular Observation, so that one may account but 11 principal Triangles, the other which are represented in the second Figure of the same Plate, having chiefly served for the verification. Here follows the list of Stations and precise Places to which Observations have been made for forming the Triangles.

- A Is the middle of the Mill of Villejuive.
- B The nearest Corn of the Pavillion of Juvisy.
- C The point of the Steeple of Brie-Comte-Robert.
- D The middle of the Tower of Montlehery.
- E The top of the Pavillion of Malvoisine.
- F A piece of Wood set up purposely on the top of the Ruines of the Tower of Monjay, and made larger with Straw tyed about it.
- G The middle of the Hidock of Mareuil, where 'twas necessary to make a Fire for a mark.
- H The middle of the great Pavillion in the Oval of the Castle of Dam-martin.
- I The Steeple of S. Samson of Clermont.
- K The Mill of Jonquiers near Compiègne.
- L The Steeple of Coyvrel.
- M A little Tree upon the Mountain of Boulogne near Montdidier.
- N The Steeple of Sourdon.
- O A little forked Tree upon the But of Griffon, near Villeneuve S. Georges.
- P The Steeple of Montmartre.
- Q The Steeple of St. Christopher's, near Senlis.
- AB Is the first Base actually measured, of 5663 Parisian Toyses.
- XY Is a second Base of 3902 Toyses, actually measured as the former.

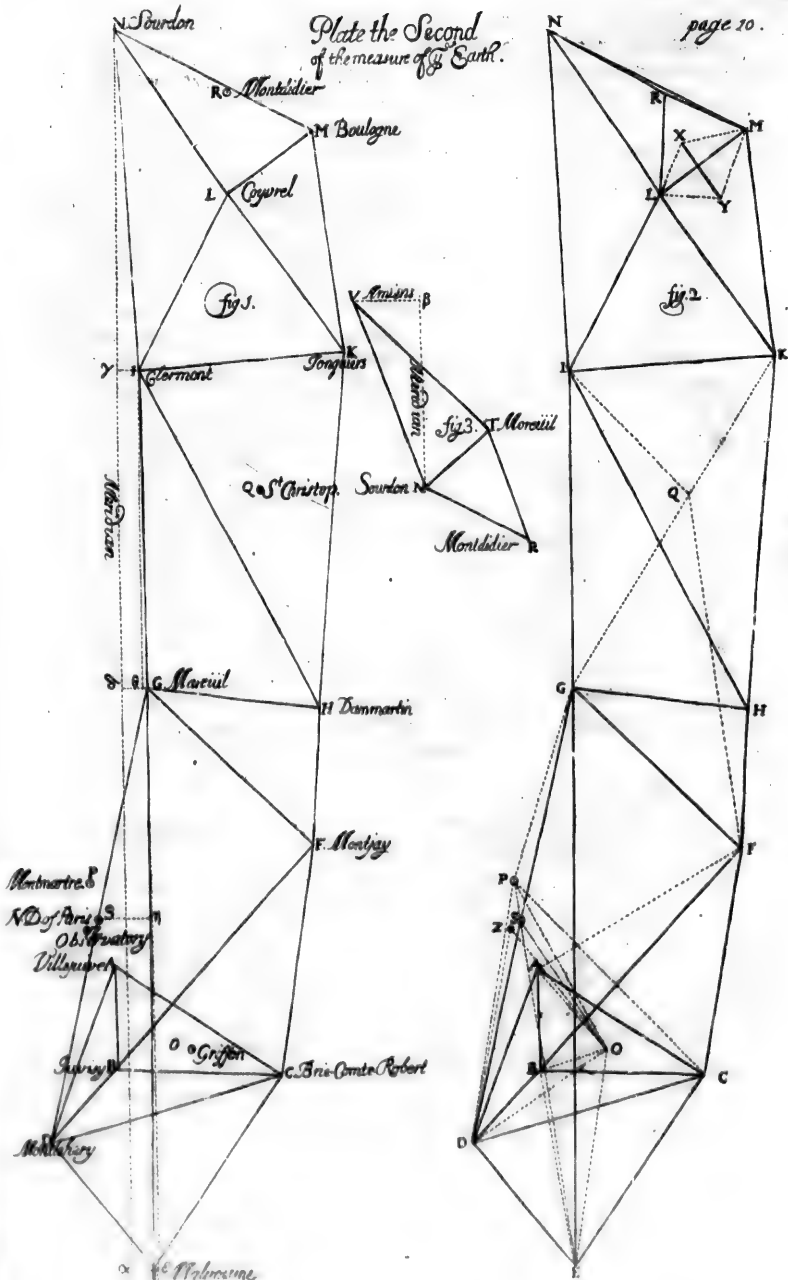
It can't be imagin'd that 'twas possible to place a large Quadrant at the point of Steeples, and of such other Places as we made choice of for forming exactly the Triangles.

But that we might have a remedy for this, we always had a care to observe the apparent thickness of Objects towards which we



Plate the Second
of the measure of γ Earth.

page 20.



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we directed. For example, in pointing at a Tower we were not content to have taken only the middle, but of how many minutes and seconds its thickness appeared, which gave means afterwards to set the Instrument on what part one would of the same Tower, in case the middle were imbarassed or inaccessible.

'Tis true that with all the precaution that could be taken, and after turning the Instrument two or three times towards the same station, 'twas impossible sometimes to avoid the error of some seconds upon the sum of the three Angles of the same Triangle; in which case there can be no difficulty of correcting the Triangle without fear of any considerable error, because all the Angles were large, and there was always some one of which there was not so much certainty as of the rest, and upon which the fault ought to be laid. The principal Corrections that were made are remarked.

In the List of the Triangles this Rule is kept, of not giving any Angle that was not observed by the Quadrant before described, and to omit those which we were obliged to conclude, though in effect there was no great difference to be made between the one and the other, because of the great preciseness with which they were directed at, and of the great care that was taken not to err in the quantity of the Angles that were observed, by reiterating several times the Observations of the same Angle, and the causing them to be made by several Observers who kept their Memoirs apart. Besides that, in the first courses that were made for the discovery of proper stations, all the Angles generally had been observed; and tho these were with lesser Instruments, which gave the minutes but by six and six; yet they were not hindered from coming to so much exactness as was necessary to make it appear that they did not all fail or err in the Conclusions.

The First Triangle A B C.

To find the side A C.

CAB $54^{\circ} 4' 35''$.

ABC $95^{\circ} 6' 55''$.

ACB $30^{\circ} 48' 30''$.

AB 5663 Toyses actually
(measured)

Then AC 11012 Toyses five
(Foot)

And BC 8954 Toyses.

**The Second Triangle, ADC
for D C and A D.**

DAC $77^{\circ} 25' 50''$.

ADC $55^{\circ} 0' 10''$.

ACD $47^{\circ} 34' 0''$.

AC 11012 Toyses 5 Foot.

Then D C 13121 Toyses
(three Foot.

And A D 9922 Toyses two
(Foot.

The third Triangle DEC.

For DE and CE
 DEC $74^{\circ} 9' 30''$
 DCE $40^{\circ} 34' 0''$
 CDE $65^{\circ} 16' 30''$
 DC 13121 Toyses 3 Foot.
 Then DE 8870 Toyses
 (3 Foot.
 And CE 12389 Toyses
 (3 Foot.

The fourth Triangle.

For DF.
 DCF $113^{\circ} 47' 40''$
 DFC $33^{\circ} 40' 0''$
 FDC $32^{\circ} 32' 20''$
 DC 13121 Toyses three
 (Foot.
 Thence DF 21658 Toyses
 (fes.

Note, That in the fourth Triangle, the Angle DFC was augmented $10''$ which were wanting to make up the sum of the three Angles.

The V. Triangle DFG
for DG and FG.

DFG $92^{\circ} 5' 20''$
 DGF $57^{\circ} 34' 0''$
 GDF $30^{\circ} 20' 40''$
 DF 21685 Toyses.
 Thence DG 25643
 (Toyses.
 And FG 12963 Toyses
 (fes 3 Foot.

From these five
 Triangles 'twas
 easie to conclude
 the distance GE
 between *Malvoifine*
 and *Mareuil*,
 without suppos-
 ing any new Ob-
 servation.

The VI. Triangle GDE
for GE.

GDE $128^{\circ} 9' 30''$
 DG 25643 Toyses.
 DE 8870 Toyses three
 (Foot
 Thence GE 31897
 (Toyses.

By the Calculation of the same Triangles were found the Angles DGE of $12^{\circ} 38'$, and DEG of $39^{\circ} 12' 30''$, the same which they were found also by Observation, which may serve as a proof for GE. And it ought to be considered, that as this Triangle is but as a consequence of the preceding, that it has two sides known, and all the Angles well established, the smallness of the Angle DGE, can't hinder the certainty of the Conclusion for GE, besides that hereafter the same distance GE shall be verified by other Triangles.

Upon the occasion of these Angles DGE and DEG, it was that Fires were made at *Mareuil*, *Montlehere*, and *Malvoifine*. A large Fire of three Foot made at *Mareuil* and seen from *Malvoifine*, appear'd to the Eye like a Star of the third Magnitude.

'Tis not our design to draw hence any conjectures concerning the fixed Stars, but only to make the following remark, That it one considers the distance of 31897 Toyses, the Fire which had three Foot of breadth ought to have been seen under an Angle of $3' 14''$, and yet when it was seen with the Telescopes of the Quadrant, of which the Object Glasses were excellent, it was not above half hid or covered by one of the silk Clews which were placed in the focus of the Telescope; now the bigness of this Filament (which was presently measured with a Microscope) was the three hundredth part of an Inch. It follows then that in a Telescope of 36 Inches it takes up the space of about $4''$. so that the Fire which it covered but half, took up the space of eight seconds, though it ought in effect have appear'd but of three seconds.

From this Experiment it may be concluded that even with Telescopes, Luminous Objects do appear bigger than they ought. It were well to make trial of this with long Telescopes, which will be reserved for another time.

We have said above that the distance EN was divided into three Lines, the first, namely GE, has been Calculated, but before we pass to the second, 'twill be much to the purpose to verify all that we have hitherto established by several other Triangles.

Another way for AD by the Triangle AOB.

A O B $62^{\circ} 21' 0''$.
A B O $75 \quad 8 \quad 20$.
B A O $49 \quad 29 \quad 40$.
A B 5663 Toyses.
Thence A O 6178 Toyses
(2 Foot.

But by the Triangle A O D.

A O D $76^{\circ} 50' 0''$.
A D O $37 \quad 19 \quad 20$.
D A O $65 \quad 50 \quad 40$.
A O 6178 Toyses.
Thence A D 9922 Toyses
(2 Foot.
And D O 9298 Toyses.

Otherwise for DE by the Triangle D O E.

D O E $47^{\circ} 0' 00''$.
D E O $50 \quad 2 \quad 50$.
E D O $82 \quad 57 \quad 10$.
D O 9298 Toyses.
Thence D E 8870 Toyses
(5 Foot.

Instead of 8870 Toyses 3 Foot.

Otherwise for CE by the Triangle A C E.

A C E $88^{\circ} 8' 0''$.
A E C $42 \quad 22 \quad 30$.
E A C $47 \quad 24 \quad 30$.
A C 11012 Toyses five Foot.
Thence CE 12388 Toyses two
(Foot.
Instead of 12389 Toyses three
(Foot.
Yet

Yet otherwise for C E in Tri-
angle B C E.

B C E $57^{\circ} 19' 30''$.

B E C 44 55 45.

E B C 77 44 45.

B C 8954 Toyses.

Thence E C 12390 Toyses.

The Angle E B C being di-
(minisht $10''$).

Otherwise yet for C E in Tri-
angle P D C.

P D C $65^{\circ} 31' 0''$.

P C D 62 2 40.

D C 13121 Toyses three
(Foot.

Thence P C 15064 Toyses
(three Foot.

And D P 14621 Toyses three
(Foot.

But in the Triangle P C E.

P C E $102^{\circ} 36' 40''$.

P E C 43 9 30.

P C 15064 Toyses three
(Foot.

Thence C E 12389 Toyses
instead of 12390 Toy-
ses three Foot.

Otherwise for D F in Trian-
gle A C E.

A C F $66^{\circ} 13' 40''$.

A F C 50 33 20.

F A C 63 13 00.

A C 11012 Toyses five Foot.

Thence A F 13051 Toyses.

But in the Triangle F A D.

F A D $140^{\circ} 38' 50''$.

A F 13051 Toyses.

A D 9922 Toyses.

Thence D F 21657 Toyses
(three Foot.

For 21658 Toyses.

Otherwise

Otherwise for F G in Triangle
G A F.

G A F $52^{\circ} 8' 50''$.

G F A $75 12 10$.

F G A $52 39 00$.

A F 13051 Toyses.

Thence F G 12963 Toyses for
12963 Toyses 3 Foot.

The sum of the two Angles

A F C, G F A exceed by $10''$,

that of the two C F D, D F G,

which is neglected, because

an error so little considerable

deserves not the exposition

self a second time to danger

in mounting to the top of

the Tower of *Monjay* which is

half ruined.

Otherwise for G E in Trian-
gle G D C.

G D C $62^{\circ} 53' 0''$ H I D

D G 25643 Toyses. H I D

D C 13112 Toyses three

(Foot,

Thence G C D $86^{\circ} 24' 25''$.

And G C 11869 Toyses three

(Foot.

But in the Triangle G C E

having put together

G C D and D C E.

G C E $116^{\circ} 58' 25''$

G C 11869 Toyses three

(Foot,

C E 12389 Toyses three

(Foot,

Thence G E 31893 Toyses

(three Foot.

Instead of 31897 Toyses, but

parting the difference we make

G E 31895 Toyses.

The VII Triangle F G H.

For G H.

F G H $39^{\circ} 51' 0''$.

F H G $91 46 30$.

H F G $48 22 30$.

F G 12963 Toyses three

(Foot,

Thence G H 9695 Toyses.

In this Triangle the Angle

G F H is diminished $10''$.



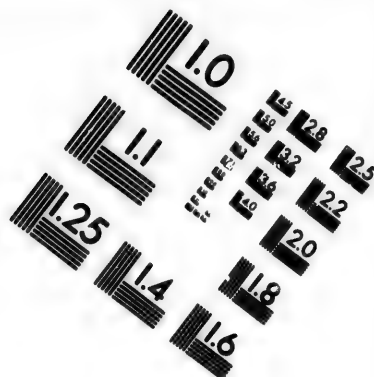
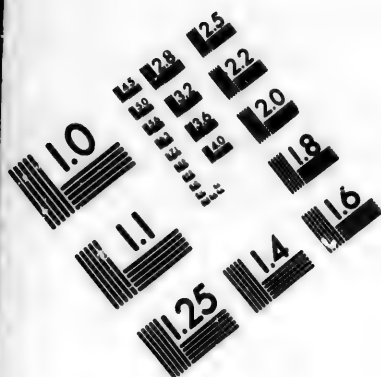
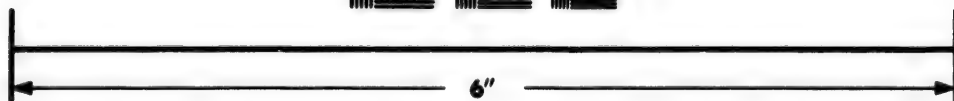
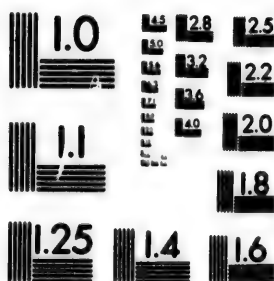


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The VIII. Triangle G H I.

For G I and I H.

G H I $55^{\circ} 58' 00''$.G I H $27^{\circ} 14' 00''$.I G H $96^{\circ} 48' 00''$.

G H 9695 Toyses.

Thence G I 17557 Toyses.

And H I 21037 Toyses.

Another way for G I in Tri-
angle Q F G.Q F G $36^{\circ} 50' 00''$.Q G F $104^{\circ} 48' 30''$.

G F 12963 Toyses three Foot.

Thence Q G 12523 Toyses.

But in the Triangle Q G I:

Q G I $31^{\circ} 50' 30''$.Q I G $43^{\circ} 39' 30''$.

Q G 12523 Toyses.

Thence G I 17562 Toyses.

And Q I 9570 Toyses.

By the Triangle Q H I, G I
is found of 17557 Toyses on-
ly, but for a reason we shall af-
ter shew, the last calculation
is followed, which makes G I
of 17562 Toyses, and by con-
sequence H I 21043 Toyses.

The IX Triangle H I K for I K.

H I K $65^{\circ} 46' 00''$.H K I $80^{\circ} 59' 40''$.K H I $33^{\circ} 14' 20''$.

H I 21043 Toyses.

Thence I K 11678 Toyses.

The sum of these three An-
gles being too great by $20''$, by
which the Angle H K I is dimi-
nished, upon which it should be
noted that the point H taken
for the middle of the great Pa-
villion on the oval of the Castle
of *Dammartin* was difficult to
determine when observed from
the station K; and that it may
happen in a distance of 19436
Toyses, the East side of this
Pavillion appear'd greaten'd by
some other adjoining Objects,
which caused the Angle H K I
to be observed bigger than it
ought.

Otherwise for I K in the Tri-
angle Q I K.

Q I K $49^{\circ} 20' 30''$.Q K I $53^{\circ} 6' 40''$.

Q I 9570 Toyses.

Thence I K 11683 Toyses.

After that which has been spoken concerning the point H, there
is cause to rest satisfied rather in this last Calculation than in that
of the Triangle H I K, so much the more for that we being assu-
red to have pointed most exactly at the Steeple of *St. Christopher*,
which was seen on all sides like a very fine Needle.

We were not able to place the Quadrant in the Steeple, nor in
that of *Coyurel* for observing the Angles, which we were there-
fore obliged to conclude. But we took so much care in observing
all the other Angles, and the Instrument gave the Circuit of the
Horison so exactly, that there ought to remain no doubt at all
upon that.

The

The X. Triangle I K L for
K L and I L.

L I K $58^{\circ} 31' 30''$.

I K L $58^{\circ} 31' 00''$.

I L 12683 Toyses.

Thence K L 11188 Toyses
(two Foot.

And I L 11186 Toyses four
(Foot.

The XI Triangle K L M for
L M.

L K M $28^{\circ} 52' 30''$.

K M L $2063131' 00''$.

K L 11188 Toyses two Foot.

Thence L M 6086 Toyses two
(Foot.

The XII Triangle L M N for
L N.

L M N $60^{\circ} 38' 00''$.

M N L $29^{\circ} 28' 20''$.

L M 6036 Toyses two Foot.

Thence L N 10691 Toyses.

The XIII Triangle I L N for
I N.

The sum of the Angles I L K
K L M M L N, being taken
from 360 , there remains

I L N $119^{\circ} 32' 40''$.

But L N 10691 Toyses.

And I L 11186 Toyses four
(Foot.

Thence I N 18905 Toyses.

So it is that upon the foundation of the first Base A B, which was actually measured, we have concluded the length of the three Lines E G, G I, I N, from *Malvoisine* to *Sourdon*.

But because the four last Triangles were not accompanied with a verification, and because we had a great desire to have a new clearing of the matter upon the VIII and IX Triangles, we judged it necessary to come to an actual measure of a new Base.

The Line of distance L M between *Coyvel* and the Mountain of *Boulogne* was found the most proper to serve for this last verification, not at all for that this Line could be actually measured, but because it passed a cross a great plain where we had the convenience to take the transversal Base X Y from the Mill of *Mery*, even almost to the Valley of *St. Martin* within a pace of *Mont-dedier*.

Which Base actually measured with the same Pike Staves made use of for the first measuring, and which had been verified all *de novo*, was found of 3902 Toyses. See here the Calculation which was made thereupon.

Of the Triangle XYL is

XYL $50^{\circ} 37' 40''$.
 YXL $64^{\circ} 20' 45''$. M 11
 XY 3902 Toyses of actual
 Thence YL 3272 Toyses
 (Foot.

But in the Triangle XYM

XYM $56^{\circ} 46' 15''$.
 YXM $65^{\circ} 29' 45''$. M 11
 XY 3902 Toyses. M 11
 Thence MY 4187 Toyses.

In fine, in the Triangle MYL

MYL $107^{\circ} 23' 35''$. M 11
 YL 3272 Toyses three Foot. M 11
 YM 4187 Toyses.

Thence ML 6037 Toyses in-
 stead of 6036 Toyses 2 Foot.

Then by proportion IN 18907
 (Toyses.

And GL 17564 Toyses.

But the EG ought to be left be-
 cause it has been several ways
 verified.

That small difference there was found between the distance which was concluded from the first Base, and that which we found by the last, made us see we had reason to suspect the Triangles which butted at the point H , and that those of the point Q had better deserved to pass for the principal. But we had no mind at all to change the order we have kept.

ARTICLE VII.

THough our first design were to terminate all our measures at *Sourdon*, yet we found a necessity as 'twere of continuing them to *Amiens*, where we resolved to go to take the height of the Pole for verifying the Calculation of *Fernelius*. We would willingly have had time enough to have sought out in the Plains of *Santerre* some point proper for finishing this measure by two great Triangles. But the Season being already too far advanced, we were fain to content our selves with what we met with in the borderings of *Sourdon*, where it was necessary to stay for taking the height of the Pole.

R is

R is the Steeple of St. Peter of Montdidier.
T a Tree upon the Mountain of Mareuil.
V the Steeple of Notre Dame d'Amicus.

Second
Plate 3d
Fig.

In the Triangle L M R.

LMR $58^{\circ} 21' 50''$.
MRL $68^{\circ} 52' 30''$.
LM 6037 Toyses.
Thence L R 5510 Toyses
(three Foot.

In the Triangle N R L.

NRL $115^{\circ} 01' 30''$.
RNL $27^{\circ} 50' 30''$.
LR 5510 Toyses three Foot.
Thence N R 7122 Toyses
(two Foot.

In the Triangle N R T.

NTR $72^{\circ} 25' 40''$.
TNR $67^{\circ} 21' 40''$.
NR 7122 Toyses two Foot.
Thence NT 4822 Toyses four
(Foot.

In fine in the Triangle N T V.

NTV $83^{\circ} 58' 40''$.
TNV $70^{\circ} 34' 30''$.
NT 4822 Toyses four Foot.
Thence N V 11162 Toyses
(four Foot.

Some have thought that we ought to have added to all these Calculations the true position of the Towers of Notre Dame of Paris, and of the Observatory.

S is a Lanthorn over the Stairs of the South Tower of Notre Dame of Paris.

Z is the middle of the South Face or Front of the building of the Observatory.

Second
Plate, first
and 2d
Figures.

In the Triangle D O S.

DOS $88^{\circ} 16' 40''$.
DSO $46^{\circ} 35' 00''$.
SDO $45^{\circ} 8' 20''$.
DO 9298 Toyses.
Thence DS 12795 Toyses.
And OS 9373 Toyses.

In the Triangle D O Z.

DOZ $82^{\circ} 5' 10''$.
DZO $51^{\circ} 34' 00''$.
ZDO $46^{\circ} 20' 50''$.
DO 9298 Toyses.
Thence DZ 11757 Toyses.
And OZ 8588 Toyses three
(Foot.

D 1

AR

R is

ARTICLE VIII.

After having measured the particular Distances between *Malvoisine*, *Mareuil* and *Sourdon*, and having added to those that of *Amiens*, the position of each of these Lines in respect of the Meridian ought to be examined.

For this purpose in the Month of *September*, 1669, we went up on the Hillock of *Mareuil*, at the place marked G, where we could see *Malvoisine* on the one side and *Clermont* on the other, and placing the Quadrant furnisht with two Telescope sights perpendicular upon its foot, so that the Telescope EF remained always in the level, whilst the plain of the Instrument was turned vertically, and that the Telescope sight of the Alidade GH pointed at the Polar Star. This Star was so followed to its greatest digression, where it remained a very sensible space of time without parting from the vertical filament of the Telescope with which it was observed, then leaving the Instrument fixed in its position the remainder of the night, even until the day was come, we could discover the place on the border of the Horison, to which the Telescope EF was found to point; and determine by this means the vertical of the greatest digression of the Polar Star. For 'twas known by experience, that when the Quadrant was set to its plumb, the two Telescopes always remained pointed in the same vertical.

By this Observation which was divers times reiterated, we were assured of a distant point which markt the vertical Circle of the greatest Oriental Digression of the Polar Star, which vertical made with the line GI an Angle of $4^{\circ} 55'$ towards the East. The complement of the declination of the Polar Star being then $2^{\circ} 28'$, and the height of the Pole on the Hillock of *Mareuil*, as it was afterward found $49^{\circ} 55'$, and by consequence the digression of the Polar Star was $3^{\circ} 46'$, then there remained yet one Degree and nine Minutes, by which the line GI declined from the North towards the West; and because that otherways the lines GI GE make an Angle of $178^{\circ} 25'$ toward the West, which Angle augmented by the declination of the line GI makes but $179^{\circ} 34'$. it followed that GE declined $26'$ from the South towards the West.

The following Year in the Month of *October*, there was chosen by *Sourdon* in the line NV, a place in the open Field, whence the Steeple of *Nostre Dame* of *Amiens* could be discovered, and in the manner explained, 'twas observed several times that this line NV declined $18^{\circ} 55'$ from the North towards the West, whence it was easie to conclude that NI declined by $2^{\circ} 9' 10''$ from the South towards the East.

These last Observations were made in a time wherein the Pole Star was found in its greatest digression a little after Sun set, and thereby we had the convenience of finishing the Observation all at once, without being obliged to leave the Instrument in its position, because

cause 'tis one of the advantages of the Telescope Sights, that by means of them one may discover the fixed Stars of the second magnitude in the greatest clearness of the *Crepusculum*, and that those of the first Magnitude may be observed in full Sun-shine, which will be a great help to Astronomy; we have made several curious Observations, which we shall hereafter Publish.

If we suppose then that the Meridian Line of *Sourdon* be prolonged toward the North, till it meets the parallel of *Amiens* at the point β for the making the Rectangle Triangle $N \beta V$, the Angle of Declination $V N \beta$, being $18^{\circ} 55'$ and the hypotenuse $N V$, being found 11161 Toyses, 4 Foot, it follows that the Meridian Distance $N \beta$ between the parallels of *Sourdon* and *Amiens* is 10559 Toyses, 3 Feet, and that the Arch of the Parallel $V \beta$ comprised between *Amiens* and the Meridian of *Sourdon* is 3617 Toyses, 4 Foot.

Second
Plate, third
Figure.

After the same manner if we suppose that the same Meridian Line of *Sourdon* be prolonged towards the South, till it meets with the Parallel of *Malvoisine* at the point α , and that this Meridian be divided into three parts by the perpendiculars $G \beta I \gamma$ which represent the Parallels of *Mareuil* and *Sourdon*, that moreover the particular Meridian Lines of those places be drawn, to wit, $G \alpha$, from *Mareuil* to *Malvoisine*, and $I \theta$ from *Clermont* to *Mareuil*.

Second
Plate, first
Figure.

In the Triangle $N \gamma I$, rectangled in γ .

NI 18907 Toyses.
 γNI $2^{\circ} 9' 10''$.
Thence $N \gamma$ 18893 Toyses,
(3 Foot.
And γI 710 Toyses.

In the Triangle $G I \theta$, rectangled in θ .

IG 17564 Toyses.
 $GI \theta$ $1^{\circ} 09' 00''$.
Thence $I \theta$ or $\gamma \beta$, 17560 Toyses, 3 Foot.
And $G \theta$ 352 Toyses.

In the Triangle $G E \alpha$ rectangled in α .

GE 31895 Toyses.
 $EG \alpha$ $00^{\circ} 26' 00''$.
Thence $G E$ or $\beta \alpha$, 31894 Toyses.
And $E \alpha$ 241 Toyses, 3 Foot.

The 3 lines $N \gamma$, $I \theta$, $G \alpha$, make together the whole Distance between the Parallels of *Sourdon* and of *Malvoisine*, of 68347 Toyses, 3 Foot;

3 Foot; to the which Distance adding that between the Parallels of *Sourdon*, and of *Amiens*, which has been found of 10559 Toyses, 3 Foot, we have the Distance between *Malvoisine*, and the Parallel of *Amiens* of 78907 Toyses: And tho in effect the four Lines of which this whole Distance is composed, are as it were the sides of a Polygon, which one would describe about the Earth; and that 'tis true in Geometrical Rigor, that the compass of such a Polygon is bigger than the circumference of the Earth; yet is it notwithstanding so little different in this case, that 'twill be to no purpose to take notice of it; since the excess upon every Degree does not amount at most to the quantity of 3 Feet, so that we may consider all these particular Lines of which the total Distance N is composed, as insensibly different from the Curvature of a Meridian.

For what remains, as we have above given the position of the Towers of *Nostre Dame de Paris*, and of the Observatory, it will be also easie for us to establish the Distances of these same places in respect of the parallels of *Malvoisine*, and of *Amiens*.

For first, if from G D, which is of 25643 Toyses, there be taken D S, found before of 12795 Toyses, there will remain 12848 Toyses for G S, which is the Distance between *Mareuil*, and the Towers of *Nostre Dame*: This Line G S makes with G E, an Angle of $12^{\circ} 34' 30''$, toward the *West*, and by consequence also it declines towards the *West* by $13^{\circ} 00' 30''$. Then having drawn S, which let be perpendicular to the Meridian of *Mareuil*, and which represents an Arch of the parallel of the Towers of *Nostre Dame*, we have

In the Triangle G S rectang-
led at s.

G S 12848 Toyses.

∠ G S $13^{\circ} 00' 30''$.

Thence G ∠ 12518 Toyses.

And S ∠ 2892 Toyses.

Second
Plate.

Then if from G ∠, which is of 31894 Toyses, be taken G ∠ 12518 Toyses, there remains ∠ ∠ of 19376 Toyses, for the Distance between the Parallels of *Nostre Dame*, and of *Malvoisine*, which may also be yet further verified by the following Calculation.

In

In the Triangle S D E.

S D E $128^{\circ} 35' 139''$ A.

S D 12795 Toyses

D E 8872 Toyses

Thence E S 19556 Toyses

And D E S $30^{\circ} 59' 30''$

But D E G $39^{\circ} 12' 30''$

Thence S E G $8^{\circ} 13' 00''$

But E G declines by $26'$ from the North towards the East, thence E S declines by $7^{\circ} 47'$ from the North towards the West, and because that the length of this same Line E. S. is 19556 Toyses, it follows, That the distance between the Parallels of *Nostre Dame*, and of *Malvoisine*, is 19376, as by the former Calculation.

In fine, in the Triangle Z D E.

Z D E is $129^{\circ} 18' 18''$

Z D is 15757 Toyses

D E 8871 Toyses

Thence E Z 18685 Toyses

And D E Z $29^{\circ} 08' 30''$

But D E S is $30^{\circ} 59' 30''$

Thence S E Z is $01^{\circ} 50' 00''$

The last Angle S E Z being added to the Declination of the Line E S which was above found of $7^{\circ} 47'$ makes the Declination of E Z of $9^{\circ} 38'$; but the length of this same Line E Z is of 18685 Toyses; thence by Reduction the Distance between the Parallels of *Malvoisine*, and of the Observatory, shall be of 18421 Toyses: And in fine, that between the parallels of *Nostre Dame* and that of the Observatory, shall be of 955 Toyses, 3 Foot.

And tho in all our Observations which we made for determining the Position of divers Lines with respect to the Meridian, we did not at all make use of the Compass (or Magnetical Needle) yet this hindred not, but that we observed the Declination of the Needle in several places principally at *Malvoisine* and at *Sourdon*: The Needle of the Compass which we carried, was 5 inches long, and its Declination at these two places, toward the end of the Summer of the Year 1670, was found to be $10^{\circ} 30'$ from the North toward the West, or thereabout, as we had some little time before observed it at *Paris*, with the same Compass, although at *Paris* the same Needle

Needle in the Year 1666 had no declination sensible, and in the Year 1664 it declined $40'$ towards the *East*, the variation thereof having been every Year above $20'$.

ARTICLE IX.

FOR concluding in fine the Magnitude of a Degree, and by consequence that of the Earth, it remains yet to know what parts of the Meridional Distances we have measured with the Toise of *Paris*, do answer to Minutes and Seconds, considering them as parts of a great Circle which should be described round about the Earth.

'Tis upon this occasion that we are obliged to search in the Heavens the Measure of the Earth, for we must necessarily have recourse to the difference of the Latitudes of the two places established under one and the same Meridian, and by this means come to the knowledge of the Arch of the Heavens comprised between the Zeniths of the said Places, the which Arch is alike to that which we have measured upon the Earth.

But before we pass to the Celestial Observations, it will be to the purpose to shew after what manner the Instruments were verified with which the observations were made; which is here so much the more necessary, for that the Telescopes which we made use of might have had some latent defect, which could not be known, but by a particular Proof.

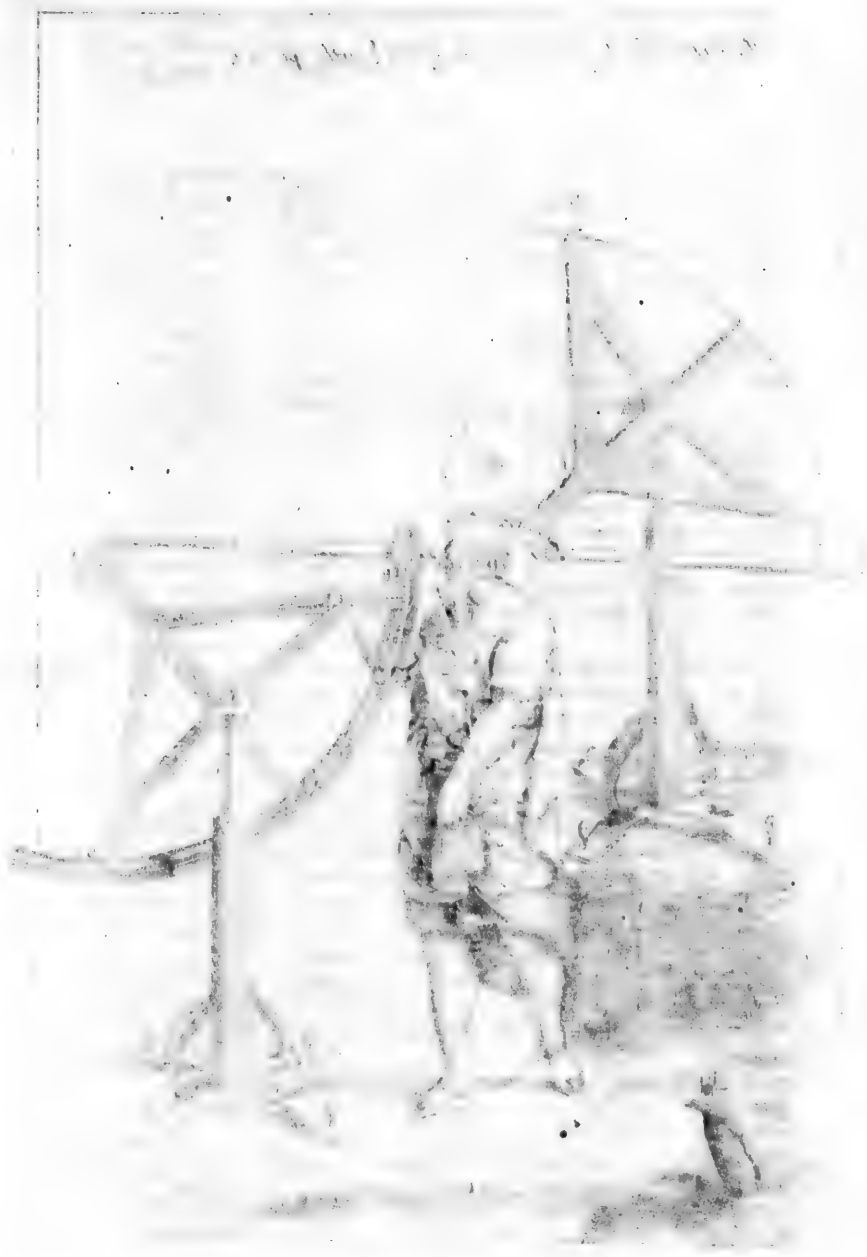
Plate the
third.

The first Figure of the 3d plate represents the Quadrant fitted upon its Foot in the ordinary manner as for taking of heights, or for directing at an Object far distant towards Edges of the Horizon; but in the 2d Figure the same quadrant is reinverted, turned from the right to the left, and directed at the same Object as before, in such sort, that the plumb line which in the former position was suspended at the Center A, and beat upon the Limb in D, is now hung upon the Limb in E, and beats precisely upon the Center A, the Instrument is also placed upon a place more elevated, to the end that after the Reversing, the Telescope might lie very near in the same line as before, tho in effect it is sufficient that it remain in a Line parallel to the former, as it will always happen if the distance of the Object be so great, that the alteration caused by the reinversion be not at all considerable, or at least if two Objects are directed at, one of which is as much below the other as the Telescope is altered by the reinversion.

Supposing then that before the reinversion, one has marked upon the Limb of the Quadrant, the point D, where the plumb line beats, and after the reinversion one has also mark'd the point E, where the plumb line is to be hanged, the Point C taken in the middle of the Interval DE shall determine the beginning of the division of the Quadrant, and if after the instrument be put into its former position the plumb line comes to beat upon the point C, the Telescope sight must

Plate the Third of the measure of the Earth pa. 24.





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necessarily be directed in the level line; so that if by chance they are at first sight so pointed, there will be found no other than the same point before and after the reinversion.

The reason of this method is easie to be comprehended, because without considering what passes in the Telescope, if we suppose that the right line A B (which passes by the center A) tends towards the Object to which the Telescope is directed, then the two Angles which the plumb line makes with the line A B, the one under, and the other above, shall be either right Angles or equal to two right Angles; they shall be right Angles when one has directed in the level, but if one has directed either too high or too low, the half of the difference of the two Angles taken from the greatest Angle, or added to the least, shall restore or give the level line.

This practice is very useful, not only for placing the Degrees upon the limb of an Instrument, following the effect of the Telescope whatever it may be; but 'tis yet further for verifying from time to time, whether the Telescope agree with the Division which we have supposed good and well centred. But to the end this Verification may be made with the more ease, the Degrees ought to be continued from C towards E, even to the end of the limb, which for this purpose ought to be greater than it need to be for 90 Degrees only,

One may verifie a Sextant very near after the same manner as a Quadrant, as we may easily see by considering, that if before the reinversing of the Instrument there be suspended from the middle of the line A B, a plumb line which falls upon the point of the 60th Degree, counting from B towards D, and afterwards the Instrument being reinversed, the same line hanging on the point of 60 Degrees, falls upon the middle of the line A B. In the one and in the other of these positions the line A B shall be in the level, and by consequence the Telescope ought to have remained pointed at the same distant Object which did mark the level line. But if on the contrary the Telescope be found to point to two Objects, of which one is above the other, the middle between the two shall be the level line. Now the Angle of difference between the level line and the one and the other of those Objects, or indeed the half of the Angle of the appearing distance between the two Objects, shall after be easily measured with a great Telescope in the manner as we measure the Diameters of the Planets: And by this means we know the error of the Instrument, the which shall augment the heights, if before the reinversment, and in the ordinary position, the Instrument be pointed at that Object which is lowest, and on the contrary it shall diminish the heights, if the Instrument is found at first pointed at that Object which was the highest.

The first and second Figures of the 4th Plate represent an Instrument, Plate 4th. which containing fewer Degrees than a Sextant, cannot be verified to the level, but only to the Zenith. This Instrument is pointed in two differing manners to the same Star near the Zenith. For in the first

E

Figure

Figure the plumb falls in D upon the Degrees of the Limb. And in the second as the Instrument is counterturned the same Plumb falls without, and is approached to the Telescope in E. Now it is easie to see that if one draws the line A B from the center A through the middle between the points D and E, marked by the two positions of the plumb Line, it shall determine the place of the Limb where the first Degree of account from the Zenith ought to begin, because that when the Telescope shall be pointed to the Zenith, the line of the plumb shall agree necessarily with the line A B.

This second manner of verifying is general for all sorts of Instruments, but it is difficult and cannot at all times be practised, because it requires a Star which shall be so near the Zenith, that after the Instrument is counterturned, and that it is pointed to this Star, the Plumb may always fall between the point B and the Telescope.

All those Instruments which serve to take heights, and which have an Alidade which one can take away when one will, are easie to be verified. The Instrument ought to be placed in the plain of the Meridian, making it perfectly immovable as if it were fixed against a Wall in such a sort, notwithstanding that the Plumb bearing towards the middle of the Limb, leaves on the one and the other side so many Degrees as are necessary for the Observations which are to be made with it. Two fixed Stars are to be made choice of, whereof the one ought to pass on this side, and the other on that side of the Zenith, and of which the difference or the sum of their Declinations do not surpass the number of the Degrees marked upon the Instrument. This being supposed, the two Stars are to be observed with the Telescope upon the Alidade according to the measure which they pass the Meridian, the one towards the North, and the other towards the South; and then provided the Instrument remains immovable, the difference between the two Observations will give exactly the Arch of the Meridian between the parallels of the two Stars, independent from all that could happen on the account of the Telescope of the Alidade. This preparation being made, the Alidade is to be taken off for putting a plumb Line in its place, and one must observe with the Telescope which is fastened to the Instrument, the apparent distance which is between the Zenith and each of these Stars taken in the Meridian, if the Instrument depresses, the sum of the two distances found by this last manner shall be too great; and on the contrary, if it raises, then it shall be too little in comparison of the total distance found by means the Alidade in such manner, that the half of the difference shall be the Error of the Instrument.

One may make a second Verification by observing one Star only, the distance of which from the Zenith doth not exceed the number of the Degrees of the Instrument to be verified, but in lieu that in the preceding manner there was no necessity to have compared the
Telescope

Telescope of the Instrument with that of the Alidade. It is necessary here that they must be both well adjusted together at one and the same far distant Object. This being supposed, one observes first with the Plumb, and with the Telescope fastned to the Instrument, the Meridional distance between the Zenith and the Star proposed, next one fixes this Instrument in the plain of the Meridian, as in the preceding manner, but in such sort, that it may be counterturned, and that if the Star be towards the South, it returned as 'twere for observing towards the North, and one observes exactly the Degree and Minute of the Limb where the Plumb beats. After this the the Plumb being taken off, one applies the Alidade, with which one observes the Meridional Distance between the Zenith and the Star, counting for this effect the Degree and Minutes which are found between the fiducial line of the Alidade, and the part of the limb where the plumb did beat before. The first distance that was found being compared with this last, shall be too little if the Instrument elevates; and on the contrary, it shall be too big if it depresses in such sort that the half of the difference shall be the error of the Instrument.

After one has known the error of the Instrument, and that one is assured that it comes not but by the Telescope, the shortest and easiest way is to let it alone, and to have regard to it, in the Observations; but if one would correct it, this may be done either by displacing the Filaments of the Telescope, or by turning the Object Glas upon its Center; so far as one knows by experience it is necessary for adjusting the Telescope to the Degrees of the Instrument. An Alidade furnishd with its Telescope may be of great help to make this correction; for this purpose one points to one and the same distant Object, as well the Telescope of the Alidade as that of the Instrument. Next, if the error is, for example, of one Minute in elevating, one sets back the Alidade a Minute; or on the contrary, one puts it nearer it, as much if the error be in depressing; and having fastned it in this position, by removing the Instrument all together, one makes the Telescope of this Alidade to stand pointed at the same Object as before; after which you must turn the Object Glas of the Telescope, which is fastned to the Instrument upon its Center, till such time as it be found pointed to the same Object; and by this means one may be assured, that a right line which shall be drawn from the Object by the Center of the Instrument, comes to meet the point B, which we suppose to have been established for the beginning of the declination.

But, for avoiding, as much as is possible the refractions of the Telescope, care must be taken that the Object Glas be well centred, which may be discovered by making it reflect the Rays of the Sun, because if it be well centred, the little focus which it makes by reflection at a certain distance, will be found exactly in the middle of a much greater round of light. Or else one may observe that the two Images which the Glas reflects of the same Object, come to unite in the middle of its surface.

After this preparation it will be to the purpose to fasten the Object Glas apart in a Copper Box pierced through its two ends, and perfectly turned round ; in which, nevertheless, it must have a little play in such sort that one may a little thrust it from one side to t'other by three Screws with their heads cut off to hold it steady ; and this Box being exactly enchased into the Objective Pinnule, one may make it turn upon its Center, mean while the whole body of the Telescope remains immoveable ; and one may observe, that if in making the Object Glas so to turn, the Telescope always remains pointed to the same Object, otherwise the Object Glas must be moved either to the one side or the other.

We thought it necessary to give all these differing ways of verification, to the end that there might remain no doubt as to the great exactness which one ought to look after in Telescopes used for Pinnules or sights of Instruments.

ARTICLE X.

IF the measure of the Earth requites precise and exact Observation, it is principally for that which concerns the difference of Latitudes, because the error of one Minute only amounts to 951 Toyses, which is multiplyed upon the whole as many times as the distance measured is contained in the whole Circumference of the Earth.

Plate 4th.
1st and 2d
Figure.

For approaching as much as is possible to the exactness requisite, the great Instrument represented in the fourth Plate was caused to be made ; it is of Iron strengthened with pieces upon the Ards of it, as the Quadrant, and covered with Copper at the places necessary. The Limb, which contains not above the 10th part of a Circle of ten Foot Radius, is divided by Diagonal Lines even to thirds of Minutes very distinctly.

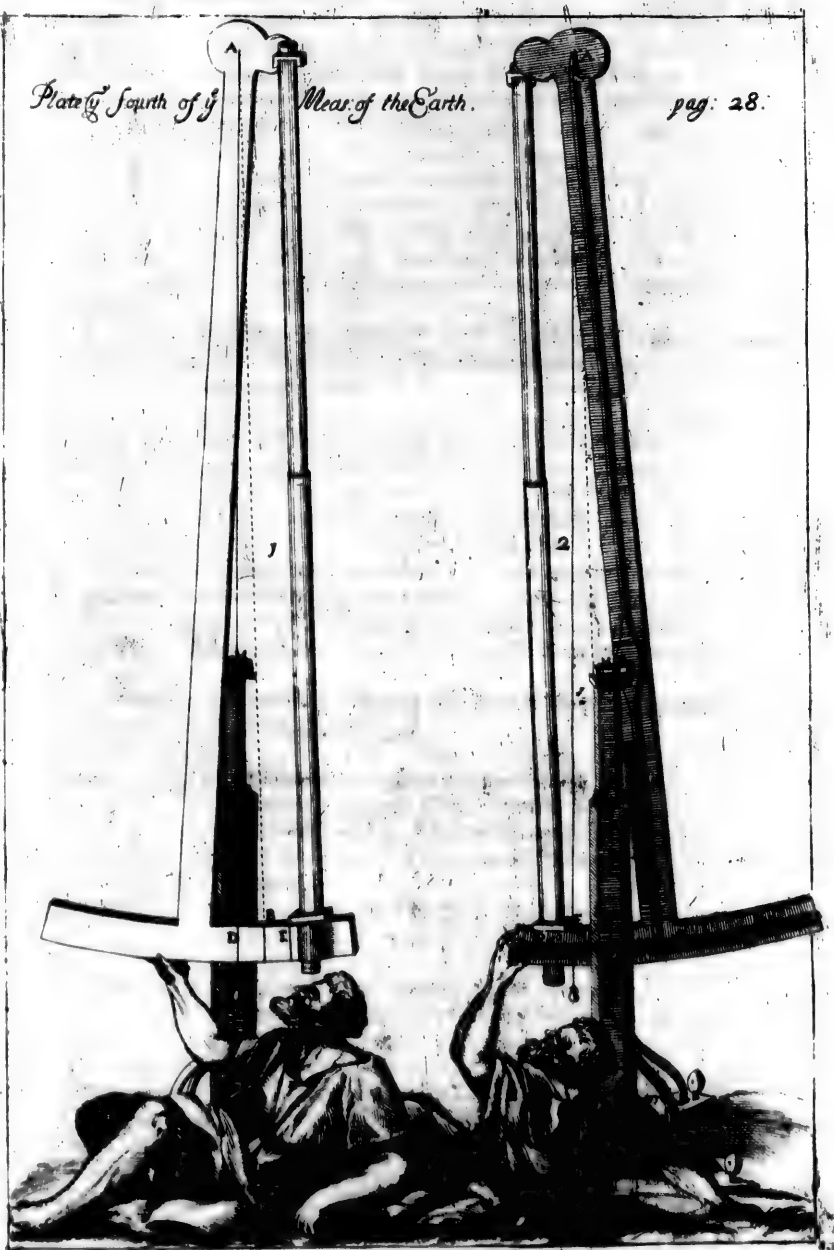
A Telescope of ten Foot serves for Pinnules or Sights to this Instrument. And because that in the obscurity of the Night one could not see the Filaments that were in the Telescope, they were enlightened by the upper end of the Telescope, or by a hole made on the side.

The Plumb or Perpendicular was secured in a Pipe of Tin, which kept it intirely covered from the Wind, beside that they always observed in a close place, of which the cover or roof was purposely pierced.

For determining, with this Instrument the differences of the Latitude of *Malvoisine*, of *Sourdon*, and of *Antens*, the Star called the *Star of Cassiopea* was made choice of, which comes to the Meridian at 9 or 10 Degrees of distance from the Zenith towards the North, about 28' 46" of time after the Polar Star. A Star more near to the Zenith would have been more difficult to be well observed. And if otherwise it should have been placed between two Zeniths, the error of the Instrument which might not possibly be

Plate 4th Fourth of 3 Meas. of the Earth.

pag. 28.





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so perfectly discovered, would have been doubled in the apparent distances of the two Zeniths, because you must then have taken the sum of the two Observations. Whereas when a Star is always observed towards one and the same Coast of Heaven, there is nothing in this case to be taken but the difference of the Observations, which cannot chuse but be exact, because the Instrument is well centered and well divided, though the Pinnules or Sights had been false.

The Knee of *Cassiopea* augments its declination every Year about 20"; we were desirous to have chosen a Star which had been less changing, as had been the bright Star of *Lyra*, or some one of *Cygnus*; but we had cause to fear, that before we should have made our Observations, the Sun would have been too near approached to these Stars.

We commonly began the Observations of the Heavens with that of the height of the Pole with the Quadrant, and every Evening about two or three hours before the Knee of *Cassiopea* was in the Meridian, we took with the same Quadrant one height of this Star, marking the Instant of Observation by means of a Pendulum Clock which gave half seconds, and which was regulated according to the Diurnal motion of the fixt Stars, and then forthwith found by Calculation at what Hour and what Instant of the same Clock the Knee of *Cassiopea* ought to be in the Meridian: And after this manner in two or three Evenings, the great Instrument was exactly pointed in the plain of the Meridian towards that part where this Star ought to pass, and then kept it in this position, because it is very difficult otherways to succeed in observing those sorts of heights which pass very swiftly.

The Meridional distances towards the North observed between the Zenith and the Knee of *Cassiopea*.

In Sept. 1670. At *Melton* in a place at a great Farm; House belonging to *Killeroy* seated on an eminence in the Parish of *Changwell*, 50° 59' 5". more South by 18 Toises than the *Parish* villon.

In Sept. & Oct. At *Sourde* in the Presbyterian House, more North than the Church by 65 38' 49" 8 Toises.

In October. At *Amiens* in the House of the King, more South than the Church by 75 28' 36" 10 Toises.

Every one of these Observations were taken from a great number of others, of which we took the middle, of which the whole variation or difference exceeded not 5". Nor will any one wonder that we were able to come to so much exactness, if he consider that it was not without exceeding great precaution, that moreover with a Telescope of 10 Foot, one need not want all of pointing exactly to a fixed

a fixed Star. And that in fine on the Instrument that serv'd for this purpose, the third part of a Minute was at least as big and distinct as a whole Minute of the Quadrant above represented. In such sort, that if upon the Quadrant one could determine a quarter of a Minute pretty exactly, and at the same time guess pretty near at $10''$, one might do the same thing here to about $3''$.

Differences of Latitude.

From Malvoisine to Saurdon	10	11'	57''.
From Malvoisine to Amiens	1	22	55.

The time which passed between these Observations required that we should have taken away $1''$ from the first of the Differences, and that in proportion the last should have been diminished by $11''$, but for avoiding a too much affected preciseness, we neglected this Correction.

ARTICLE XL

Plate the
Second.

ALL these Observations being supposed, it will be easie thence to conclude the magnitude of a Degree upon the Earth. For this effect it must be considered, that at Malvoisine the Observations of Heaven were made at 18 Toises more towards the South than the Point N. that on the contrary at Saurdon, it was at 65 Toises more towards the North than the Point N. And thus by consequence 83 Toises should be added to the distance of 68347 Toises, 3 Foot, which are found between the Parallels of Malvoisine and of Saurdon; in such manner that the difference of $10^{\circ} 11' 57''$ observ'd by the Heavens, answers upon the Earth to a Meridional distance of 68430 Toises, 3 Foot, one may thence in fine conclude, That in proportion a Degree shall be of 57064 Toises, 19 Foot.

The Calculation made by the distance of Amiens differs not at all from the former, for the distance between the Parallel of Notre Dame d' Amiens, and that of the Pavilion of Malvoisine is of 78907 Toises; there ought to be taken from the side of Amiens, for the place of Observation, 75 Toises; and on the other side to add the 18 Toises of Malvoisine; then all the compensation made, there will be 78850 Toises, for the difference of $10^{\circ} 22' 55''$, and in proportion the degree shall be of 57057 Toises, which number approaches in such sort to the first, that we were surpris'd so much the more, that if we had kept account of the Corrections which we have neglected of the differences of Latitude, these two Calculations would have been yet more approaching to each other. It is possible that this is but an effect of chance, since notwithstanding all the exactness we were capable of, we could not answer to two Seconds, and consequently to the value of about thirty two Toises, upon every observation. We may nevertheless say with some certainty, that we are not

not very far from the true measure of a degree; though one may come to a yet greater preciseness, by measuring with the same care and with like Instruments a distance much greater than that of *Malvoisine* and *Amiens*. We will fix notwithstanding upon the round Sum of 57060 Toyses for a degree of a great Circle of the Earth.

'Tis here principally, that the measure taken from Pendulums, ought to be employed, which we have supposed * universal, or at least invariable for every place; and which is to the *Parisian* Toyle, as 881 to 864, because following this proportion, the degree shall be of 55959 universal Toyses, of which every one contains two lengths of a pendulum of Seconds of mean time, so that there wants but 41 of these Toyses upon a whole degree to make up the Round Number of 56000. And by consequence the degree to be of 28 Universal Miles, such as we have determined them.

To the end that strangers may participate of this work, without being obliged to have recourse to the length of a Pendulum of Seconds, we shall give the length of a degree, expressed according to the particular Measures of which we could gain the knowledg.

Supposing then *The Paris Foot*, of 1440 parts.

The Rhein or Leyden Foot 1390.

The London Foot 1350.

The Boulogne Foot 1686.

The Braze of Florence 2580.

A Degree of a Great Circle of the Earth, according to the Measures of divers places will contain

Toyses of the Castle of Paris	57060.
Paces of Boulogne	58481.
Verges of Rhein of 12 foot each	29556.
Parisian Leagues of 2000 Toyses	28.
Midling Leagues of France of about 2282 Toyses	25.
Marine Leagues of 2873 Toyses	20.
English Miles of 5000 Foot each	73.
Florence Miles of 3000 Brazes	63.

The Circumference of the Earth.

Of Parisian Toyses 20541600.

Of Leagues of 25 in a degree 9000.

Of Marine Leagues 7200.

The Diameter of the Earth.

Of Parisian Toyses 6538594.

Of Leagues of 25 in a degree 28644.

Of Marine Leagues 22915.

It may be said, that as we have measured the Globe of the Earth by the top of Mountains, or by places more elevated than the rest, it will follow that a degree, such as we have determined, is bigger than that we should find in going still upon the Sea shore, where it should seem that the Measure ought to be considerably less: But that we may see whether this be so, suppose that the line from *Malvoisine* to *Sourdon*, be in all its length, equally removed from the borders of the Sea about 35 Leagues, and that conformable to the Experiments that have been made upon the Seine, the declivity of Rivers, which cross this Line, be about 5 Foot to a League; this shall make at most but 30 Toyses of Declivity, even to the Sea, and putting about 50 Toyses for the height that our Line might have above the Rivers, we shall find that this Line might be elevated about 80 Toyses above the level of the Sea. Whence it would follow that a Degree upon the Sea would be less above 8 Foot, than that we have measured upon the Land, which is not at all to be considered in this matter.

A Table for the value of a Degree of a great Circle of the Earth; divided into

Minutes and Seconds.

Minutes	Toyses	Seconds	Toyses
1	951	1	16
2	1902	2	32
3	2853	3	48
4	3804	4	63
5	4755	5	79
6	5706	6	95
7	6657	7	111
8	7608	8	127
9	8559	9	143
10	9510	10	158
20	19020	20	317
30	28530	30	475
40	38040	40	634
50	47550	50	792
60	57060	60	951

It will not be at all difficult hence to find the differences of the heights of the Pole, for all those places of which we have calculated the Meridional Distances, because 'tis but changing the said Distances into Minutes and Seconds, according to the value of a Degree.

The

The Differences of the Heights of the Pole

between Mal-voisine and	The Observatory of Paris	19' 22''
	Noſtre Dame of Paris	20' 22''
	Mareuil	33' 32''
	Clermont	52' 00''
	Sourdon	71' 52''
	Noſtre Dame of Amiens	82' 58''
Between Noſtre Dame of Paris, and Noſtre Dame of Amiens		62' 36''

The height of the Pole at *Paris* in the Garden of the Kings Library, by many observations of the Polar Star made in the Winter Solstices has always been found $48^{\circ} 53'$, you must substract $50''$, and you have the height of the Pole of *Paris*, about the Towers of *Noſtre Dame* of $48^{\circ} 52' 10''$, or if one had rather design the middle of *Paris* between the Gates of *St. Martin*, and of *St. James*, which is a little way from *St James* of the *Butchery* or *Shambles*, the height of the Pole of *Paris* will be $48^{\circ} 52' 20''$. And we are certain that if the heights of the Pole be fixed, it will have little change from this, tho in the Observatory one may come to a much greater preciseness: we count not the refractions which the Polar star may have, which will be known in time The height of the Pole of *Noſtre Dame* of *Paris* being supposed we establish the following heights of the Pole conformable to the differences here above established.

The Latitudes and height of the Pole

	Malvoisine	48° 31' 48''
	The Observatory	48 51 10
	Noſtre Dame of Paris	48 52 10
of	Mareuil	49 5 20
	Clermont	49 23 48
	Sourdon	49 43 40
	Noſtre Dame of Amiens	49 54 46

The difference of the longitudes of these places require a little more of Calculation than that of the Latitudes, because after we had found in a parallel the distance between the Meridians of two places, we reduced this distance to that which is in the Equator between those same Meridians which were changed into Minutes and Seconds of a great Circle conformable to the Table above. After this manner we found

<i>Sourdon</i>	} More East than	<i>Amiens</i>	5' 54".
<i>Clermont</i>		<i>Sourdon</i>	1 9
<i>Mareuil</i>		<i>Clermont</i>	0 34
<i>Mareuil</i>		<i>Malvoisine</i>	0 20
<i>Mareuil</i>		<i>Paris</i>	4 37.

Whence 'tis easie to conclude that the difference of Longitude between *Sourdon* and *Malvoisine* is only 1' 23", which confirms the first thought we had that these two places were very near under the same Meridian.

It follows also that *Paris* about the Tower of *Nostre-Dame*, is not above 3' more Eastward than *Amiens*. And because that in the Parallel of *Paris* 3' amount to 1877 Toyses, one must conclude that *Chalais*, which may pass for one of the Suburbs of *Paris*, is very near in the same Meridian with *Nostre Dame* of *Amiens*.

It would be advantageous to Astronomy if we knew as exactly the difference of Longitude between the Observatory of *Paris* and *Uraniburg*, of which one may account more than two Degrees difference, till such time as by Observation made at the same time in these two places, and compared together, we shall be ascertain'd of the truth.

ARTICLE XII.

Whereas the ordinary method of taking the Level is subject to a correction, upon supposal that the semidiameter of the Earth is known, which according to our Calculation is of 3269298 Toyses 3 Foot; We have judg'd it significant to give here a Table for the correction of the apparent level, and on that occasion we shall speak concerning refractions which intermingle themselves with these kind of Observations, and which hinder them from being serviceable for the Measure of the Earth.

'Tis known that the true Level requires an equal Distance from the Center of the Earth, yet nevertheless we ordinarily seek the Level in a streight Line, which goes off from the said Center in the manner of a Tangent, hence it is that the true Level is below the apparent.

If instead of taking the Level on one side only, the observer be placed in the middle between the two points which are to be levelld, from each of which he is equally distant, he will have in this case no correction to make, because the risings will be equal both on the one side and the other side: but without being forced to this method since the length of the Semidiameter of the Earth is known, the height of the apparent Level above the true is easily found, provided 'tis known at what distance one is from the Object seen; in the same manner as the bigness of the semidiameter of a Circle being known, and that of a Tangent the excess of the secant without the Circle is found.

A Table

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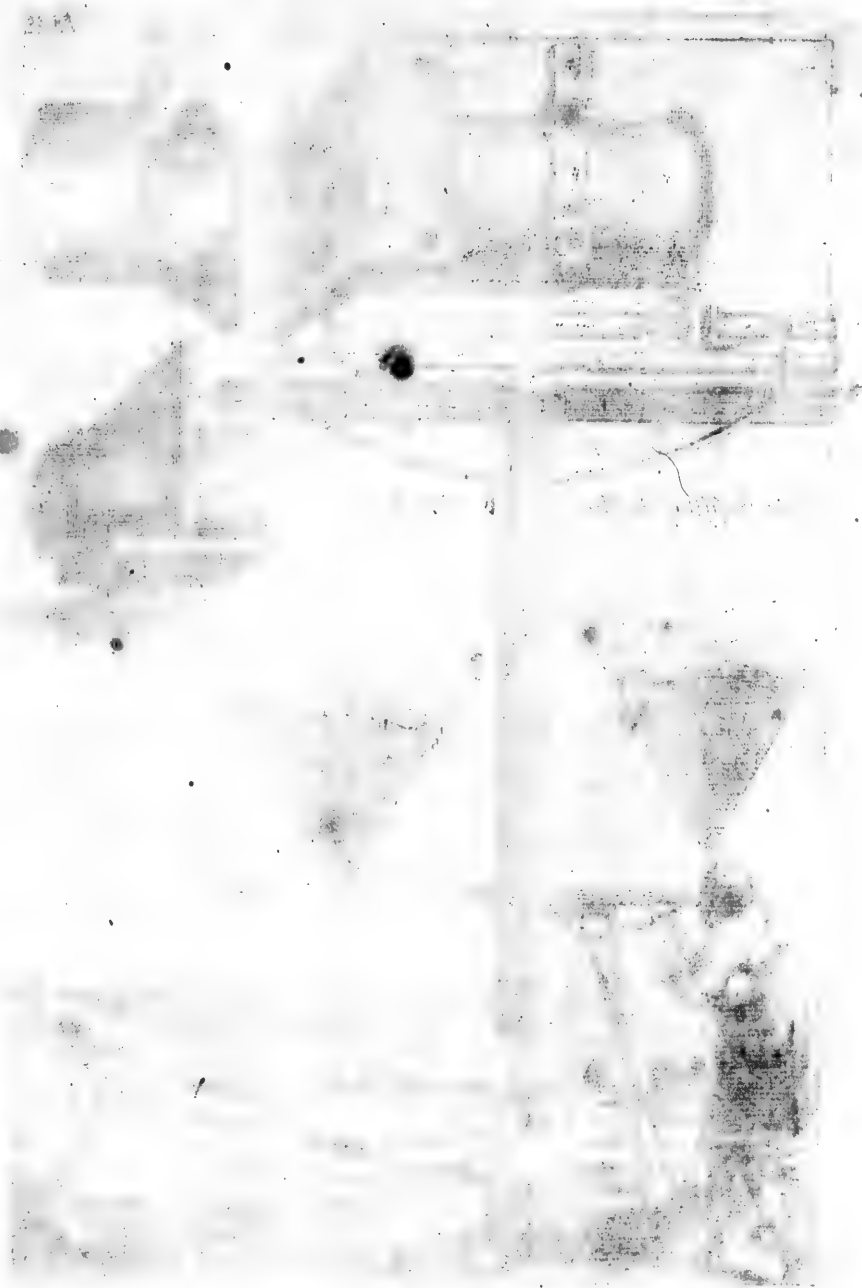
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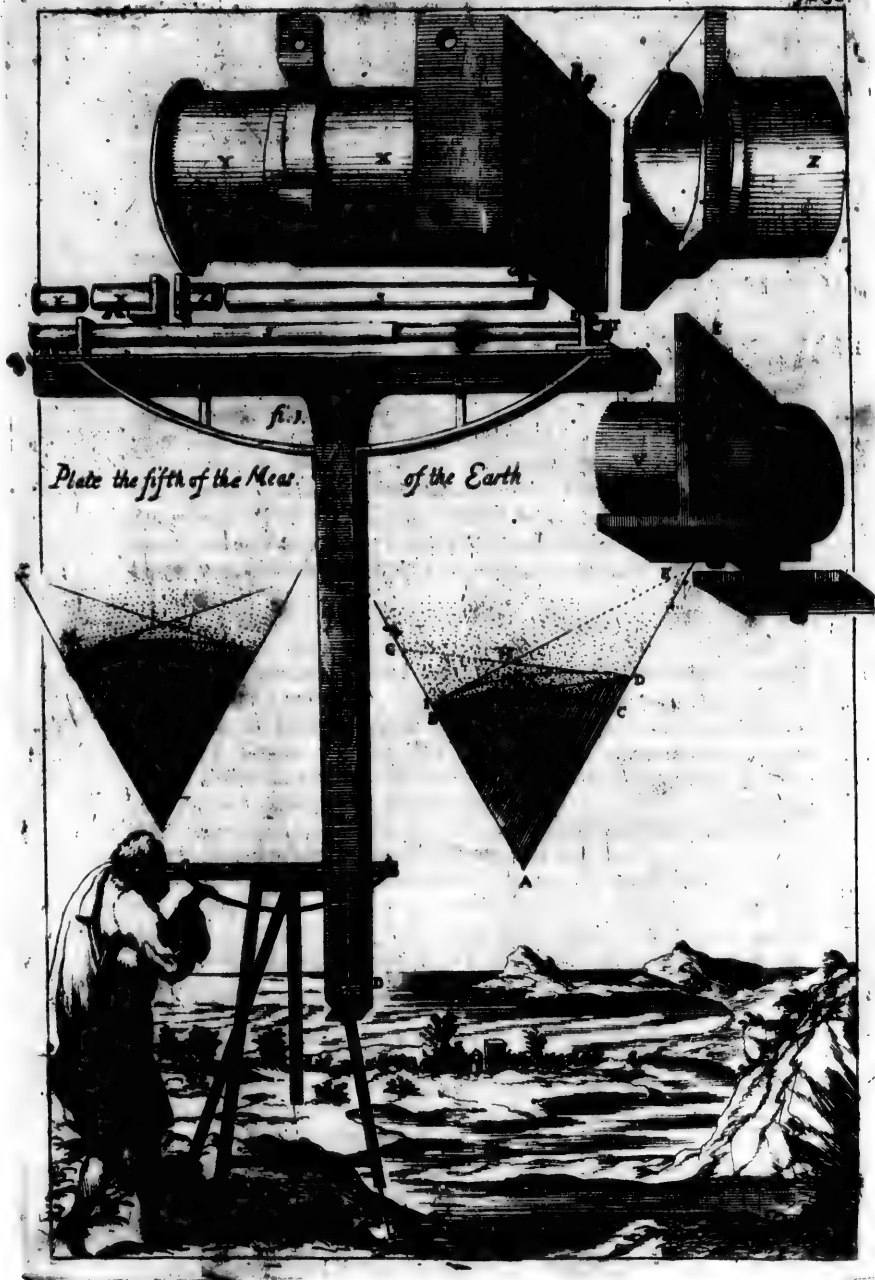
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A Table





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A Table of the Heights of the appearing Level above the true.

Distances.

Heights of the apparent Level.

Toyses.	Feet.	Inches.	Lines.
50	0	0	0 $\frac{1}{2}$
100	0	0	1 $\frac{1}{2}$
200	0	0	5
300	0	0	11 $\frac{1}{2}$
400	0	1	9
500	0	2	9
600	0	3	11
700	0	5	4 $\frac{1}{2}$
800	0	6	11 $\frac{1}{2}$
900	0	8	9 $\frac{1}{2}$
1000	0	11	0
1500	2	0	9
2000	3	8	0
2500	5	8	8 $\frac{1}{2}$
3000	8	3	0
4000	14	8	0

This Table makes it appear that the heights of the apparent level are not at all considerable under 1000 Toyses of Distance, but beyond this they may cause a sensible error, because they increase considerably, and pretty near, as the squares of the Distances.

Those who know not by experience what advantage one may now receive by using Telescope-sights instead of the common sights, will not fail to say that this Table can be of no use, because they have not yet had an Instrument with which they could distinguish the difference that there is between the apparent level and the true. We can notwithstanding assure them, with our Quadrant, which was not more than of three Foot Radius, or with the Instrument of which we are going to give a description, we determined the level to 18 Inches in a distance of 3000 Toyses, for which, according to the Table, eight Foot and three Inches of correction must be made.

The Description of an Instrument proper for observing the Level.

THE Body of this Instrument which is all of Iron, is composed of two principal Rules. The Rule A B is three Foot long, and two Inches broad, it is strengthened underneath by another Rule, to the middle of which is fixed the stem C D, three Foot

Fifth Plate
first Fig.

Foot and an half long, and perpendicular to the plain of the Rule A B. This Item is fitted with two pieces set edgewise parallel to each other, and which being covered with a very thin Plate, make a square Tube, within which the plumb line or perpendicular G H is inclosed, which is seen through two Glasses which answer to the two extremities thereof. It has also a third opening at the bottom of the Tube, through which, with ones Finger, the motion of the plumb may be stayed.

Article 5. Upon the plain of the Rule A B is fastned the Telescope E F, which is of the same make with that which we have described for the Quadrant; and tho all the pieces have been already represented in the first Plate, yet we judged it not impertinent to represent it once more in another order, and a bigger size: But that we might not be obliged to repeat the Discourse, we have put to it the same Letters.

A Painters Æsell serves for a support to this Instrument, and for accommodating it to the inequality of the ground, the Rule A B is arched underneath with two bows which bear upon the two pins of the Æsell; that it may be easie to raise or sink the direction of the Telescope as there shall be need, without altering the Æsell; and when the ground happens to be unequal, one may lengthen this or that Foot of it by the means of a rod of Iron which is joynted to it.

With this Instrument the level may be determined at one glance to a very great distance, even much more than is set down in the precedent Table. But there is generally one great obstacle upon the account of refractions, which makes the Objects appear above the line, they ought to be seen in. For example, in the second Figure let A be the center of the Earth, B C its ordinary surface, and D I the tops of the Mountains, we are to consider that the Earth is inveloped with an Atmosphere or vaporous Air composed of different Regions, which are more subtil the further they are removed from the Earth, but in such sort that the change is not made all at once, but by Degrees, the visual Ray which comes from a higher place to a lower, as from D to I, which passes obliquely from a more subtil to a more gross Air, is continually bent in its way in proportion as it changes the *medium*, which gives it the position of a curve line, much like that of D F I, but the Eye that is in I, receives the curve Ray as if it were the Tangent I E, in which it sees the Object D. For the same reason if we suppose another eye in D, it sees the Object I in the strait line D G, tangent to the same bended Ray D F B: And supposing that the two tangents I E and D G which are in place of the visual rays cut each other in H, one may imagine that there happens the same thing, as if the two Objects D and I were respectively seen with one only refraction which should be made in H. and which should be equivalent to all those of the true Ray D F I.

For discovering of these refractions, and also for knowing the total value of them which we suppose reduced to the Angle D H E or I H G. the two Angles A I E and A D G ought to have been observed,

observed, and moreover the Angle A known, by means of the distance BC or ID. changed into Minutes and Seconds of a great Circle of the Earth; because the excess of these Three Angles above 180 Degrees is the total refraction.

The Third Figure represents Two Mountains of equal height, but so far distant, that the visual Ray cannot pass from the top of one, to the top of the other, without sensibly approaching nearer to the surface of the Earth, and without being consequently broken or refracted in its way, which 'tis not necessary farther to explain. You must always set apart all the irregularities which may happen every moment in the constitution of the Air.

It will be enough for practise, that one can inform ones self of the refraction when there is any, and that otherwise it may be avoided in the Observation of the Level, by contenting ones self with middle stations.

Divers Authors report a thing which we have often tryed; which 'tis convenient to note here, that an Object which at break of the Day has appear'd in the Level, and sometimes a little above it, has afterwards when the Sun is up, appeared below it, and on the contrary after the setting of the Sun, Objects far distant appear'd to be rais'd so sensibly, that in less than half an Hour their apparent height has been augmented more than Three Minutes.

The cause of these appearances is, that the coolness of the Night condenses the Vapours, which descend to a lower place, leaving the Air of the higher Stations more pure than in the time of the day, which causes a great Refraction on the contrary when the motion of the Sun has made a part of the Vapours to mount to the more elevated stations, there must be less difference of the Medium, and consequently less of Refraction.

We shall add here one Experiment which makes it appear contrary to the Opinion of some Authors, that even at Noon day there remains somewhat of Refraction when the distance is great, and that the visual Ray cannot pass from one place to another without approaching the Earth. The last Summer being on the top of the Towers of *Nostre Dame* of *Paris*, we pointed the quadrant towards the Tower of *Mont Leberie*, and we found that the foot of this Tower was precisely in the apparent Level: This was about Noon in a very Serene time. Some days after at the same Hour, the height of the Tower of *Nostre Dame*, observed from the foot of the Tower of *Montleberie*, appear'd below the Level line 11'. 30". whereas conformable to the distance of 12796 Toises, which there are between these two places, this Angle ought to have been 13'. 30". whence it appears that it had Two Minutes of refraction in the whole.

This experiment shews what exactness one may expect from those who after *Marinichus* pretend to have found the Magnitude of the Earth, by means of the apparent Level; they suppose that for this purpose, one should chuse a very high Mountain near the Sea shore; and

and having measured the height of this Mountain, one tries upon the Sea at what distance the top of it can be seen. But the refractions which are yet greater upon the Sea than upon the Land, render this practice fallacious, because they enable us to discover Objects at a much greater distance than the convexity of the Sea ought to permit, and by consequence make the Earth appear much greater than in effect it is.

ARTICLE XIII.

IT remains now to Examine the differing Opinions touching the Magnitude of the Earth. And because we can say nothing of the Ancients but by Conjecture; we shall begin with *Fernelius* who
 *Article 1. as we said at the * beginning has estimated a Degree to contain 56746 Toyses.

It is without doubt surprizing, that by a manner so gross as his was, he has approacht so near to that measure which we have concluded on from so many Observations, the place which he took to be the bound of the Degree he had undertaken to measure, was found (by report of the People of the place) as he himself says, at twenty five Leagues of *Paris*, whence he set forth. And besides, this could not be far out of the Road from *Paris* to *Amiens*; because these two Cities are very near, under the same *Meridian*, and that he must have gone directly towards the North; they commonly account 28 Leagues distance between *Paris* and *Amiens*. It was therefore at 3 Leagues on this side of *Amiens*, and by consequence in a place less advanced Northwards by 6'. at least, but the difference of the heights of the Pole of *Paris*, and of *Amiens*, is 62' 36". whence it follows that *Fernelius* ought not to account above 56' 36". when he thought he had advanced a whole Degree; so that it must necessarily be that the Error was compensated by the estimate which he made of the Length of the Way.

As for *Snellius*, who gives not above 55021 Toyses, if one considers what we have elsewhere already taken notice of *, that it is founded upon too little a Base; if we add to this, the multitude of his Triangles, the smallness of several Angles, the Correction of three, and sometimes of 4. Minutes, which he was forced to make in the same Triangle; and in fine, 'tis not known by what means he observed the heights of the Pole; we shall less wonder that notwithstanding all his care and pains, he did not succeed so well as *Fernelius*.
 *Article 3.

Father *Riccioli* has erred on the other hand, making a Degree to amount to 64363 *Bolnionian* Paces, or to 81 Ancient *Italian* Miles, according as he determines them; but he measured not above a third part of a Degree, which is too little, and besides it is easie to shew what might have deceived him.

Let us imagine, that in the 2d Figure of the 5th Plate, I is the top of the Tower of *Modena*, D the top of the Mountain of *Paterne*, near

near *Boulogne*, and A the Center of the Earth. Father *Riccioli* in his Geography (*lib. 5. chap. 33.*) assures us that by many observations made at the times which were least suspected for Refractions he always found the Angle A D I of $89^{\circ} 26' 13'' 27'''$. and the Angle A I D of $90^{\circ} 15' 7''$ supposing that the two terms I and D were viewed by one strait Ray. the sum of these two Angles makes $179^{\circ} 41' 20'' 27'''$ and by consequence the Angle A, or the Arch B C, is according to this Observation of $18' 39'' 33'''$; but the distance is of 20016 *Bowonian* paces thence by Proportion an intire Degree should be 64363 *Bologne* paces, which make about 62900. Toises of *Paris*.

This Method which was proposed by *Kepler*, appears so much the more simple, for that there was no need of any Cœlestial Observation, and that it supposes only that the Plumb or Perpendicular tends directly to the Center of the Earth, which we have also supposed. But we may demand of Father *Riccioli*, how he could be assured that in his Observations, he had not any thing of Refraction. It was, says he, at Noon, in places very high elevated. But besides, that one of those Places is much higher then the other; the following Experiment joyned to what we have related before, will make one see what Judgment ought to be made of this Method.

In the Month of *August* of the year 1669. the Top of the Hillock of *Mareuil* observed at Noon, from the foot of the Tower of *Montleberie*, appear'd below the Level $8' 20''$; and some days after at the same hour, the foot of the Tower of *Montleberie* reciprocally observ'd from the Top of the Hillock of *Mareuil*, was found below the Level $13' 40''$. If there had been no Refraction, these two little Angles together would have made the Angle at the Center of the Earth, between *Montleberie* and *Mareuil* of $22'$, but the distance is 25643. Toyses: thence in Proportion a Degree should be 69935. Toyses, which will exceed very much, not only the greatness which we have determined by the Heavens; but even that which Father *Riccioli* has found. The Measure without doubt will yet come forth much bigger in respect to two Objects, that shall be further distant then *Mareuil* and *Montleberie*: In such sort that 'tis evident that this method ought to be intirely rejected as fallacious and uncertain.

It may be said, That Father *Riccioli*, understanding well what Refractions would do, did not wholly content himself with this method; but that he did verify it by Cœlestial Observations. But after what manner soever it is in *Italy*, where the Refractions possibly are not so great as here; We have not at all found that the Observations made for the Measure of the Earth, by the means of the Level did agree with those of the Heavens, which we can confirm by divers like Examples to those which we have produced: As one may see in the Geography of the said Author, (*Lib. 5. cap. 27.*) that of the two Observations of the Heavens, one of which gave him $19' 19''$, and the other $21' 16''$, of apparent distance between the Zenith of

Ferrara

Ferrara, and that of the Mountain of *Paterne*, he made choice of the first, as of that which agreed best with his Calculation; whereas, if he had followed the second Observation, we should have found very little difference between us.

Geogr.
Reform. I.
5 c. 37.

The same Author for the last proof of his Opinion, says, That the distance from *Avignon* to *Lyons*, taken out of the *Itineraries*, accords perfectly with the difference of the heights of the Pole of those two Cities at the rate of 8 r. ancient Miles for one Degree conformable to his Opinion. It were to be wisht that one knew the just Distance between *Lyons* and *Avignon*; and likewise, that one had to that add the distance from *Chalons* on the *Saone*, for one should then have a line of many Degrees almost in a Meridian. Nevertheless one may answer Father *Riccioli*, that the distances reckoned by the *Itineraries* which he cites, were not measured with exactness enough for the Measure of the Earth, and that he will have a considerable difference between one Itinerary distance, taken in following the great Road, and that which might be measured in the shortest line. Of these *Itineraries*, that which is attributed to the Emperor *Antoninus*, but which do's often pass under the Name of *Antonius Augustus*, is full of considerable faults; not giving always the same distance between the same two places, as one may see in comparing the Road from *Millan* to *Aries*, with that from *Millan* to *Vienna*. The second Itinerary, which is that of *Bordeaux* and of *Hierusalem*, seems to be the work of some particular Person, who had described his own Travels. And a little Examination will shew that 'tis different from the first in several places, and that the particular distances of several Places between *Aries* and *Millan*, are not at all found to be the same. So that to conclude 'tis not in the least reasonable to regard such kind of Testimonies against a measure exactly taken.

ERRATA.

Page 1. l. 25. r. *the*. l. 31. r. *to*. p. 2. l. 41. r. *Alomar*. p. 3. l. 6. r. *for*. p. 4. l. 30. r. *five*. p. 8. l. 11. r. *five*. p. 12. l. 19. 21638. p. 13. l. 4. r. 3¹¹. 14¹¹¹. l. 34. r. 42^o. 27¹. 30¹¹. l. 35. r. 49^o. 24¹. 30¹¹. p. 16. l. 35. r. *this*. p. 18. l. 16. r. *GI*. p. 19. l. 3. r. *Amiens*. l. ult. r. 9073. p. 23. l. 4. r. 8871. l. 16. r. 11737. p. 27. l. 8. r. *be turned*. p. 28. l. 25. r. *Area*. p. 30. l. 8. r. 12.

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